A Field Guide for the Identification and Interpretation of the Engelmann Spruce - Subalpine Fir Zone in the Prince Rupert Forest Region, B.C.

Land Management
Handbook NUMBER 17

ISSN 0229-1622

March, 1989

BC
Ministry of Forests

103-06748/

A Field Guide for Identification and Interpretation of the Engelmann Spruce-Subalpine Fir Zone in the Prince Rupert Forest Region, British Columbia

by
D. Yole[1], T. Lewis[2], A. Inselberg[3], J. Pojar[4], D. Holmes[4]

[1] Consulting Pedologist
Box 3862
Smithers, B.C. V0J 2N0

[2] Consulting in Soils and Land Use
6149 Burns Street
Burnaby, B.C. V5H 1X3

[3] Consulting Ecologist
4473 Canterbury Crescent
North Vancouver, B.C. V7R 3N8

[4] Forest Sciences Section
Ministry of Forests
Bag 5000, Smithers, B.C. V0J 2N0

March, 1989

BC
Ministry of Forests

Canadian Cataloguing in Publication Data

Main entry under title:
A Field guide for identification and interpretation of the Engelmann spruce-subalpine fir zone in the Prince Rupert Forest Region, British Columbia

(Land management handbook, ISSN 0229-1622 ; no. 17)

Bibliography: p.
ISBN 0-7718-8745-0

1. Bioclimatology - British Columbia. 2. Biogeography - British Columbia. 3. Forest ecology - British Columbia. 4. Forest management - British Columbia 5. Prince Rupert Forest Region (B.C.) I. Yole, D. II. British Columbia. Ministry of Forests. III. Series.

QH541.5.F6F53 1989 581.5'2642'09711 C89-092062-1

© 1989 Province of British Columbia
Published by the
Research Branch
Ministry of Forests
31 Bastion Square
Victoria, B.C. V8W 3E7

Copies of this and other Ministry of Forests titles are available from Crown Publications Inc., 546 Yates Street, Victoria, B.C. V8W 1K8.

ACKNOWLEDGEMENTS

A. Banner assisted in both early field work and 1985 field work. K. McKeown assisted with field work and data processing. S. Lindeburgh and A. Macadam were involved in field work and prepared the interim report that preceded this guide. K. Awmack, M. Blouw, W. Chapman, A. Deas, S. Haeussler, D. Knowles, R. Laird, M. O'Neill, L. Ricciotti, B. Robinson, J. Schwab, R. Trowbridge, D. Wilford, and K. Yearsley all participated in the early field work. Final figures were prepared by E. Coulson and P. Nystedt. M. Stewart and H. Zandberg did the word processing.

Support of the Regional Silviculture Section of the Ministry of Forests made the field work and production of this guide possible.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS iii

1 INTRODUCTION 1

2 USE OF THE GUIDE 1
2.1 Identifying Subzones 3
2.2 Prominence Values of Major Species of the ESSF Subzones 3
2.3 Identifying Site Units 3

3 BIOGEOCLIMATIC UNITS 6
3.1 Synopsis of the Subzones of the ESSF 8
3.1.1 ESSFk — Continental Northern Subzone 8
3.1.2 ESSFi — Subcontinental Northern Subzone 8
3.1.3 ESSFl — Subcontinental Central Subzone 8
3.1.4 ESSFkp, ESSFip, ESSFlp: parkland subzones 9
3.2 Neighbouring Biogeoclimatic Units 9

4 THE ESSFk SUBZONE 10
4.1 Site Units of the ESSFk — Continental Northern Subzone 11
4.2 Key to Site Units of the ESSFk 12
4.3 Description and Interpretation of Site Units of the ESSFk 13

5 THE ESSFi SUBZONE 40
5.1 Site Units of the ESSFi — Subcontinental Northern Subzone 41
5.2 Key to Site Units of the ESSFi 42
5.3 Description and Interpretation of Site Units of the ESSFi 44

6 THE ESSFl SUBZONE 66
6.1 Site Units of the ESSFl — Subcontinental Central Subzone 67
6.2 Key to Site Units of the ESSFl 68
6.3 Description of Site Units of the ESSFl 70

7 LITERATURE CITED 80

APPENDICES

1 Tree species symbols used in the guide 81
2 List of plant names used in the guide 82

TABLES

1 Characteristics of the three forested Engelmann Spruce — Subalpine Fir subzones of the Prince Rupert Forest Region 4
2 Synopsis of vegetation characteristics of the ESSFk, ESSFi, and ESSFl subzones and adjacent biogeoclimatic units 5
3 Environmental features of site units in the ESSFk 16
4 Summary of silvicultural prescriptions and guidelines for the ESSFk 18
5 Environmental features of site units in the ESSFi 46
6 Summary of silvicultural prescriptions and guidelines for the ESSFi 48
7 Environmental features of site units in the ESSFl 71
8 Preferred and acceptable species for site units in the ESSFl 73

FIGURES

1 The Engelmann Spruce — Subalpine Fir Zone (ESSF) in the Prince Rupert Forest Region, exclusive of the Cassiar Timber Supply Area 2
2 Physiographic regions of the ESSF zone in the Prince Rupert Forest Region 7
3 The Continental Northern Engelmann Spruce — Subalpine Fir Subzone (ESSFk) in the Prince Rupert Forest Region 10
4 Edatopic grid of the ESSFk 11
5 Schematic sequence of ecosystems in the ESSFk landscape on the Nechako Plateau 14
6 Prominence values for major species of the ESSFk 15
7 The Subcontinental Northern Engelmann Spruce — Subalpine Fir Subzone (ESSFi) in the Prince Rupert Forest Region 40
8 Edatopic grid of the ESSFi 41
9 Schematic sequence of ecosystems in the ESSFi landscape in the Nass Basin 43
10 Prominence values for major species of the ESSFi 45
11 The Subcontinental Central Engelmann Spruce — Subalpine Fir Subzone (ESSFl) in the Prince Rupert Forest Region 66
12 Edatopic grid of the ESSFl 67
13 Schematic sequence of ecosystems in the ESSFl landscape within the Tahtsa Ranges 69
14 Prominence values for major species of the ESSFl 70

1 INTRODUCTION

This field guide describes forest ecosystems and silvicultural interpretations for the Engelmann Spruce — Subalpine Fir Zone (ESSF) in the Prince Rupert Forest Region (Figure 1). The guide concentrates on three forested subzones: the ESSFi (Subcontinental Northern) subzone, the ESSFk (Continental Northern) subzone, and the ESSFl (Subcontinental Central) subzone.

The guide uses the Biogeoclimatic Ecosystem Classification (BEC) system, which integrates and organizes climatic, soil, and vegetation information into recognizable management units for use in the field. The B.C. Ministry of Forests intends the BEC system to be used as a tool to improve forest and range management through collection, organization, and interpretation of forest ecosystem data.

This field guide contains information condensed from draft reports by Lindeburgh *et al*[1]. and Lewis *et al*[2]. We assume that the user is already familiar with the basic concepts and methods of site, soil, and vegetation evaluation from other field guides and/or training programmes offered by the Ministry of Forests. Therefore, this field guide does not include material on plant identification, soil texturing, or classification of soils or humus forms. To identify unknown plants, consult Pojar *et al.*(1982) or Coupe *et al.*(1982). For soil terms and classification, refer to CSSC (1978). See Klinka *et al.* (1981) for humus form terms and classification. Consult Lewis *et al*[2]. for more detailed information on principles and philosophy, methods of the classification, physiography, geology, terrain, soils, climate, and silvicultural interpretations for the various site units or subzones described in this guide. For complex or unrecognizable site features, inquiries should be directed to the Regional Ecologist, Prince Rupert Forest Region. See also Coates and Haeussler (1987) for a guide to mechanical site preparation.

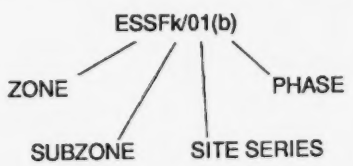
The guide includes ecological information, maps, and identification keys to assist the user in identification and interpretation of the ecological units of the ESSF zone.

The area covered by this guide encompasses subalpine forests of the Kalum, Kispiox, Bulkley, Morice, and Lakes TSA's. Although the ESSF zone also occupies high elevation forests of southern portions of the Cassiar TSA, plot work was concentrated in areas south of Bowser Lake. Site descriptions are not included for the ESSF parkland subzones (ESSFkp, ESSFip, ESSFlp) because they have limited forest productivity and harvesting potential.

2 USE OF THE GUIDE

The Biogeoclimatic Ecosystem Classification system integrates climatic (zonal), vegetation, and site (ecosystem) classifications. The climatic classification subdivides the province into broad geographical areas termed biogeoclimatic zones, subzones, and variants (where applicable). Biogeoclimatic units are characterized by zonal (climatic climax) vegetation units.

In the site classification, environmentally similar ecosystems can be grouped and defined. Sites with similar vegetation potential and soil characteristics for a given subzone or variant are termed site series (formerly ecosystem association). The site series may be further partitioned, based on physical and/or chemical soil properties, into phases or site types. Refer to Pojar *et al.* (1987) for a detailed discussion of the BEC system and recent changes in terminology. A standard code is used to indicate the classification categories used in this guide. For example:



---

1 Lindeburgh, S., A. Macadam, and J. Pojar. 1983. Ecosystem classification and interpretation of the Engelmann Spruce — Subalpine Fir Zone, Prince Rupert Forest Region, British Columbia. B.C. Ministry of Forests, Smithers, B.C. Unpubl. rep.

2 Lewis, T., A. Inselberg, and J. Pojar. 1987. A guide to the ecosystems of the Engelmann Spruce — Subalpine Fir Zone in the Prince Rupert Forest Region. B.C. Ministry of Forests, Smithers, B.C. Unpubl. rep.

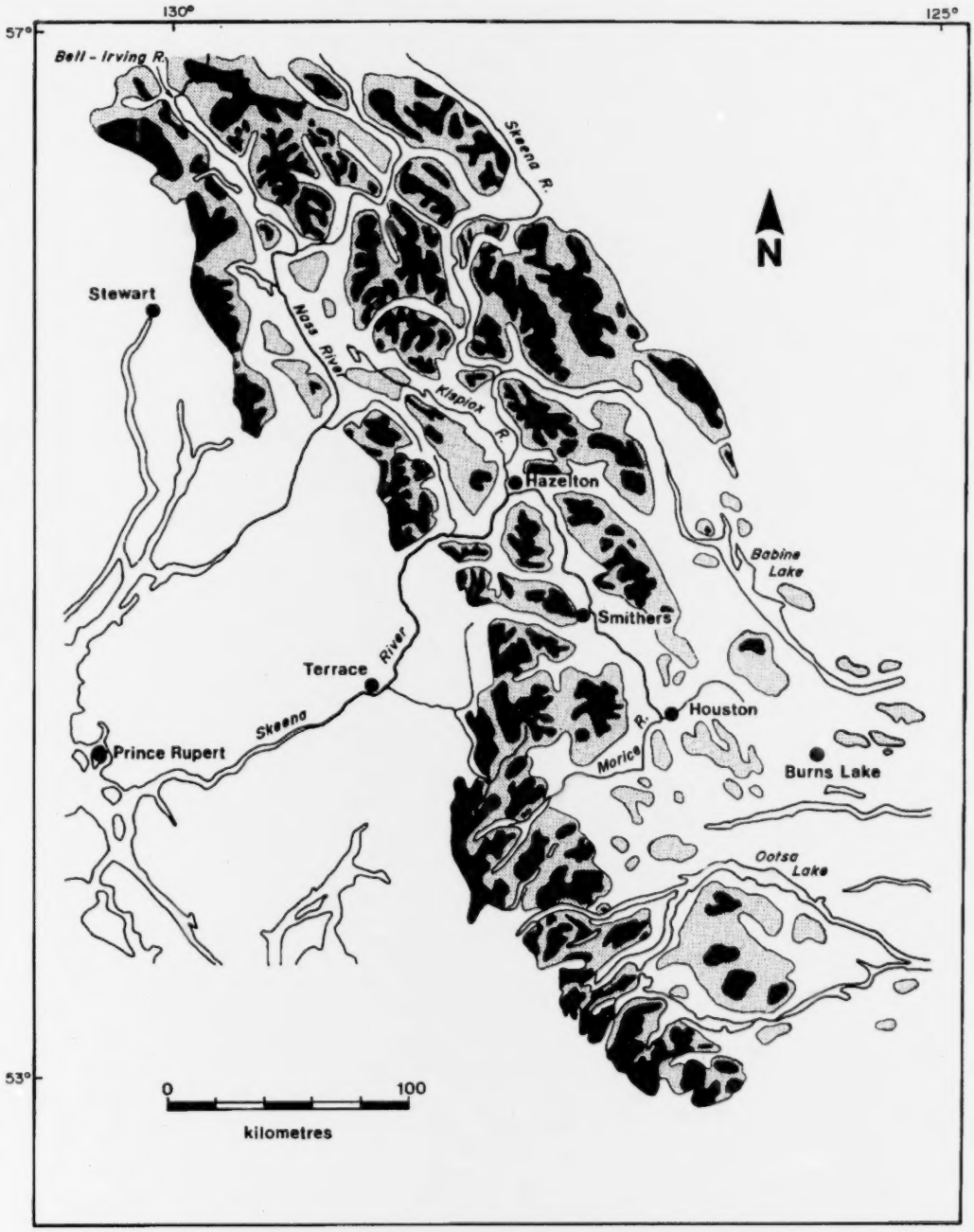


FIGURE 1. The Engelmann Spruce — Subalpine Fir Zone (ESSF) in the Prince Rupert Forest Region, exclusive of the Cassiar Timber Supply Area. ESSF is stippled; black areas denote Alpine Tundra Zone and glaciers.

Connotative common names are often used for the various categories; for example, the Fine-textured phase of the Black Huckleberry — Bunchberry — Moss site series [ESSFk/01(b)].

Using this guide involves two main steps: identifying the biogeoclimatic subzone; then identifying the site series.

The guide is structured in a standard format for each biogeoclimatic subzone, with the following information supplied for identification of the zonal and site units:

- map of the subzone
- edatopic grid
- key to site units
- slope transect
- prominence value diagrams for major plant species
- table of environmental features of the site units
- description and interpretation of the site units

2.1 Identifying Subzones

Maps for ESSFk, ESSFi, and ESSFl can be found at the beginning of sections 4, 5, and 6, respectively. Refer also to Pojar (1988) for a map at a scale of 1: 500 000 of the biogeoclimatic units (including the ESSF subzones) of the entire Prince Rupert Forest Region.

To determine the correct zone, first consult Pojar (1988) or the zone map of Figure 1 (p. 2). Then, choose the appropriate subzone by checking Pojar (1988) or subzone maps in Figures 3 (p. 10), 7 (p. 40), and 11 (p. 66), and by comparing habitat and floristic features of each subzone in Tables 1 and 2 (pp. 4–5). If still in doubt, identify the site for both feasible subzones. The site descriptions and interpretations for each subzone can then be compared and the most appropriate option selected.

2.2 Prominence Values of Major Species of the ESSF Subzones

Prominence values are a measure of plant abundance, incorporating both % frequency of occurrence and % cover of the species. The prominence of a given species is therefore a value that can be used to compare vegetative characteristics of a given biogeoclimatic or site unit. Prominence values are calculated by:

$$PV = \text{mean cover} \times \text{square root of frequency}$$

Figures 6 (p. 15), 10 (p. 45), and 14 (p. 70) illustrate prominence values for major species of the ESSFk, ESSFi, and ESSFl subzones, respectively. Circles of various sizes proportional to PV denote the relative prominence of major species; i.e., those with a prominence value greater than or equal to 50.

2.3 Identifying Site Units

Sections 4, 5, and 6 present information for the ESSFk, ESSFi, and ESSFl subzones, respectively, of the Prince Rupert Forest Region. These sections include information needed to identify site units (site series and phases) of the three subzones. Descriptions of other ESSF subzones with little or no commercial timber value (i.e., parkland subzones) are summarized in Section 3.1.4.

The following steps are suggested to determine the classification of a site:

Step 1

Consult a biogeoclimatic map and Tables 1 and 2 (pp. 4–5) to determine in which subzone the site occurs.

Step 2

Walk the area in question and note some of the more obvious site and soil factors used in assessing moisture and nutrient regime. Look for pronounced differences in vegetation, surface wetness, or slope position — this may indicate that more than one site unit is present. For each relatively similar area, determine the moisture and nutrient regime, and place the site on the edatopic grid of the appropriate subzone. Note relevant features of the site, including slope postion, slope gradient, aspect, soil texture and development, depth of soil and water table, presence of mottling or gleying, coarse fragment content, type of humus, and depth of humus.

Step 3

Note the dominant plant species present on the site, their abundance, and their vigour.

TABLE 1. Characteristics of the three forested Engelmann Spruce — Subalpine Fir subzones of the Prince Rupert Forest Region

Subzone	ESSFk	ESSFi	ESSFl
Geographic distribution	above the SBSmc; leeward flanks of Nechako Plateau, N. Bulkley Ranges, E. Skeena Mtns.	above the ICHmc & vc; E. Boundary Ranges, W. Skeena and centr. Hazelton Mtns.	Kitimat Ranges; also Tahtsa and S. Bulkley Ranges
Elevational range	950–1500 m in N 1200–1800 m in S	900–1550 m	1000–1800 m
Snowpack	0.7–1.5 m	1.2–2.0+ m	ca 2.0 m[b]
Precipitation	450–650 mm	650–1100+ mm	ca 1000 mm[b] (dry summers)
Major trees	Bl[a],Sx,Pl	Bl,Hm,Sx,Hw	Bl,Hm,Ba,Pa,Pl
Understory features	moderate shrub, poor herb, and well-developed feathermoss layer dominated by *Pleurozium; Barbilophozia lycopodioides* common	relatively diverse vegetation cover; well-developed shrub and moss layers; moderately developed herb layer; *Pleurozium, Hylocomium,* and *Ptilium* common	sparse shrub and herb layers; moss layer dominated by *Dicranum* and *Barbilophozia floerkei*; *Pleurozium* sparse; lichens common on mesic sites
Zonal plant association	Bl-*Vaccinium membranaceum-Cornus canadensis-Pleurozium schreberi*	Bl-Hm-*Vaccinium membranaceum-Menziesia ferruginea-Rubus pedatus-Pleurozium schreberi*	Bl-(Hm,Ba)-*Vaccinium membranaceum-Clintonia uniflora-Dicranum fuscescens-Barbilophozia floerkei*
Zonal soils	Humo-Ferric Podzols and Podzolic Gray Luvisols	Ferro-Humic Podzols	Humo-Ferric Podzols
Humus form	Hemimors 2–7 cm	Hemihumimors 5–15 cm	Hemimors 2–5 cm

[a] Tree species abbreviations as in Appendix 1.
[b] Very limited climatic data available.

TABLE 2. Synopsis of vegetation characteristics of the ESSFk, ESSFi, and ESSFl subzones and adjacent biogeoclimatic units

Species[a]	Biogeoclimatic subzones[b]						
	ESSFk	ESSFi	ESSFl	ICHmc/vc	SBSmc	MHb	SWB
Coniferous trees:							
Bl	****[c]	****	****	***	****	***	****
Ba	—	*	***	*	—	***	—
Sx	**	*	*	***	***	*	—
Hw	—	*	+	****	+	**	—
Hm	+	**	***	+	—	****	—
Cw	—	—	—	***	—	—	—
Pl	**	+	**	***	****	—	*
Pa	*	+	**	—	—	+	—
Sw	—	—	—	—	—	—	**
Deciduous trees:							
Dr	—	—	—	—	—	—	—
Acb	—	—	—	—	—	—	*
Act	+	—	—	**	*	—	—
At	—	—	—	***	***	—	*
Ep	—	—	—	***	*	—	—
Shrubs:							
Vaccinium membranaceum	****	****	****	***	****	***	*
V. alaskaense	—	+	—	*	—	***	—
V. ovalifolium	*	**	***	**	+	***	—
Menziesia ferruginea	*	***	**	*	+	***	—
Shepherdia canadensis	+	—	—	**	***	—	*
Rubus spectabilis	+	+	+	*	—	+	—
Corylus cornuta	—	—	—	**	—	—	—
Sorbus sitchensis & *S. scopulina*	**	**	***	*	**	***	—
Alnus viridis ssp. *sinuata*	**	***	*	***	**	**	*
Betula glandulosa	+	+	—	+	+	—	****
Herbs:							
Valeriana sitchensis	***	***	**	+	+	***	—
Veratrum viride	***	***	***	+	+	***	*
Senecio triangularis	**	**	**	—	+	*	**
Chimaphila umbellata	—	—	—	***	+	—	—
Goodyera oblongifolia	—	—	—	***	*	+	—
Rubus pedatus	****	****	***	***	****	****	*
Linnaea borealis	*	+	—	***	****	—	**
Gymnocarpium dryopteris	**	***	**	****	****	***	—
Lycopodium annotinum	***	**	*	***	***	*	*
Festuca altaica	*	*	+	—	—	—	****
Mosses and Liverworts:							
Pleurozium schreberi	****	****	**	***	****	***	***
Hylocomium splendens	*	***	+	****	**	**	****
Ptilium crista-castrensis	**	***	+	****	****	+	+
Rhytidiopsis robusta	*	*	+	**	+	***	—
Rhytidiadelphus triquetrus	—	+	+	***	+	+	+
R. loreus	—	*	+	*	—	**	—
Barbilophozia spp.	****	****	****	**	*	****	**
Dicranum spp.	***	**	***	*	*	****	***

[a] See Appendix 2 for a list of scientific and common names. Tree species abbreviations as in Appendix 1.

[b] Abbreviations of biogeoclimatic units: ESSFk, Continental Northern Engelmann Spruce — Subalpine Fir Subzone; ESSFi, Subcontinental Northern Engelmann Spruce — Subalpine Fir Subzone; ESSFl, Subcontinental Central Engelmann Spruce — Subalpine Fir Subzone; ICHmc/vc, Moist Cold/Very Wet Cold Interior Cedar — Hemlock Subzone; MHb, Submaritime Mountain Hemlock Subzone; SBSmc, Moist Cold Sub-Boreal Spruce Subzone; SWB, Spruce — Willow — Birch Zone.

[c] Key:

**** dominant	* uncommon
*** widespread	+ rare
** common	— absent

Step 4

Use the information from steps 1, 2, and 3 to work through the site unit key for the appropriate subzone. Proceed to the indicated site series. If this site series encompasses the moisture and nutrient regimes established in Step 2, proceed to Step 5. At this stage, refer to Figures 6 (p.15), 10 (p.45), or 14 (p.70) for information regarding relative prominence of species in the climax vegetation of the various site series.

Remember that the frequency and abundance of plant species depends on the successional status of the site, and the type and degree of disturbance that initiated succession. The information presented in the keys, prominence value diagrams, and site unit descriptions pertain primarily to late seral and mature stages (forest stands older than 80 years). In recent clearcuts, burns, or other early seral habitats, rely more on physical site indicators (slope position, soil features) than plant indicators.

Step 5

Compare the site and its vegetation and soil with that summarized for the indicated site unit. If there is a reasonable fit, proceed to step 6; if not, consult with regional ecology staff.

Step 6

Consider the management interpretations suggested for the site unit. These are located on the page following the site description or in the appropriate "Comments" section. Logging history and silvicultural experience within the ESSF zone are limited. Hence, recommendations for silvicultural practices have not been included for all site units.

Because there has been no logging activity in the ESSFl, and it is unlikely there will be logging in the near future, silvicultural interpretations are not included on a site series basis for this subzone. If the need arises, the user should refer to management interpretations for similar site units in the ESSFk subzone.

3 BIOGEOCLIMATIC UNITS

The ESSF zone in the Prince Rupert Forest Region is a subalpine, primarily forested zone that occurs at elevations between 950 and 1600 m, lying above and contiguous with the SBSmc (formerly SBSe) and the ICHmc and ICHvc (formerly combined in the ICHg) subzones. The zone falls within southern portions of the Skeena Mountains, eastern sections of the Hazelton Mountains, and the highest parts of the Nechako Plateau and Nass Basin physiographic subdivisions (Figure 2).

Forests of the ESSF experience short, cool growing seasons and long, cold winters. Compared to neighbouring subzones of the ICH and SBS, the ESSF has a greater snowpack. The three ESSF subzones can be differentiated on the basis of differences in snowpack and growing season precipitation (Table 1).

The most common plant species occurring throughout forested sections of the ESSF include subalpine fir, *Vaccinium membranaceum*, *Rubus pedatus*, *Barbilophozia* spp., and *Dicranum fuscescens* (see Appendix 2 for a list of scientific and common names). Hybrid spruce is generally found in older mature stands that owe their origin to wildfire. Incidence of fire is greatest above SBS sections of the Nechako Plateau, where summer storms and lightning occur more often than in the mountains to the north and west. Mountain hemlock and western hemlock are relatively common in the western portions of the ESSF, which are wetter and snowier than eastern portions. Lodgepole pine is a common seral species through most of the zone except the northern parts, while whitebark pine occurs largely on dry, gravelly or rocky sites south of the Skeena River.

Avalanche tracks are a common feature in the steep, mountainous terrain. Slide vegetation commonly includes *Alnus viridis* ssp. *sinuata*, *Senecio triangularis*, *Veratrum viride*, and *Heracleum sphondylium*.

Forested areas of lower and middle elevations contain relatively open stands. Mature trees often show frost damage and/or other scars indicative of a stressful environment. *Rhododendron albiflorum*, a characteristic and widespread shrub of ESSF forests elsewhere in British Columbia, is rare in the Prince Rupert Forest Region.

At upper elevations of the zone, open parkland-type vegetation is common, with characteristic clumps of short trees among heath and meadow communities. Heath communities are typically dominated by one or more species of dwarf woody plants such as *Cassiope mertensiana* and *Phyllodoce empetriformis*. Moist, rich subalpine meadow communities include such species as *Lupinus arcticus*, *Valeriana sitchensis*, *Senecio triangularis*, *Erigeron peregrinus*, *Artemisia arctica*, *Arnica latifolia*, *Veratrum viride*, and *Festuca altaica*.

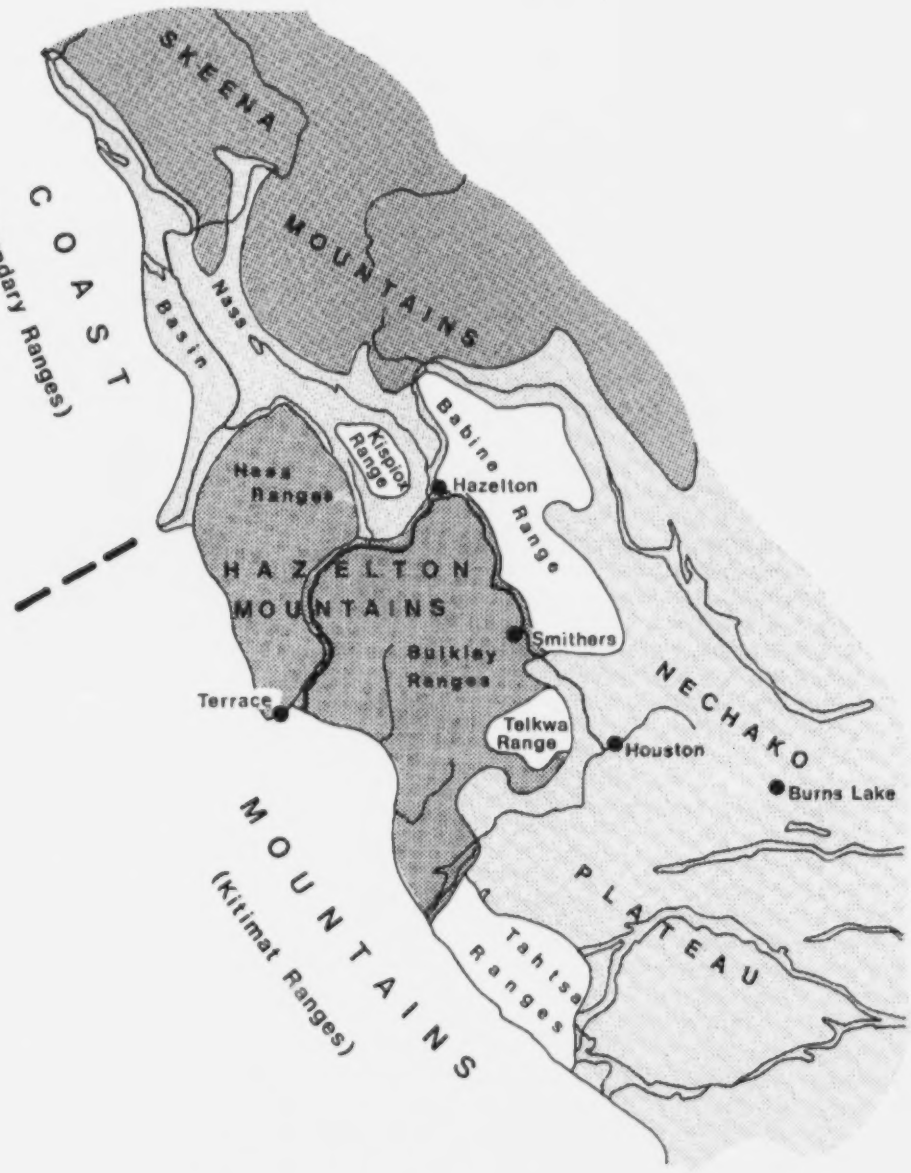


FIGURE 2. Physiographic regions of the ESSF zone in the Prince Rupert Forest Region.

FIGURE 2. Physiographic regions of the ESSF zone in the Prince Rupert Forest Region.

The more or less continuously forested part of the ESSF in the Prince Rupert Forest Region has been divided into three subzones based on differences in vegetation and regional climate:

1. ESSFk — Continental Northern Subzone
2. ESSFi — Subcontinental Northern Subzone
3. ESSFl — Subcontinental Central Subzone

3.1 Synopsis of the Subzones of the ESSF

3.1.1 ESSFk — Continental Northern Subzone

The ESSFk subzone in the Prince Rupert Forest Region lies directly above the SBSmc subzone, at elevations between 1200–1800 m in the south, and 950–1500 m in the northern sections. The ESSFk occupies the highest portions of the Nechako Plateau, and also occurs between the SBSmc and the Alpine Tundra Zone in the Telkwa Range, and along the eastern side of the Skeena Mountains, including the Babine Range.

The ESSFk has the most continental climate of the three subzones; with cold winter temperatures, relatively low annual precipitation (450–650 mm), and lighter snowpack (70–150 cm) than the other ESSF subzones.

Subalpine fir, hybrid spruce, and lodgepole pine are the dominant coniferous tree species in the ESSFk. Subalpine fir is always present in climax stands, while various mixes of lodgepole pine and hybrid spruce appear along with subalpine fir in seral stands. Whitebark pine may occur with lodgepole pine on the driest sites. Virtually ubiquitous understory species of the ESSFk include *Cornus canadensis*, *Arnica cordifolia*, *Orthilia secunda*, *Pleurozium schreberi*, *Barbilophozia lycopodioides*, and *Peltigera aphthosa*. Increased prominence of *Veratrum viride*, *Valeriana sitchensis*, and liverworts help distinguish the ESSFk from the SBSmc. In addition, the feather mosses *Ptilium crista-castrensis* and *Hylocomium splendens* are less abundant in the ESSFk than in the SBSmc or ESSFi.

Humo-Ferric Podzols and Podzolic Gray Luvisols are typical zonal forest soils in the ESSFk. Zonal humus forms are most often Hemimors, with dominant Fq horizons in which fungal decomposition predominates.

3.1.2 ESSFi — Subcontinental Northern Subzone

For the most part, the ESSFi lies above the ICHmc and ICHvc subzones in the northernmost sections of the ESSF Zone. The ESSFi occurs between elevations of 900–1500 m in the southwestern portion of the Skeena Mountains to Hazelton, the central section of the Hazelton Mountains, the highest parts of the Nass Basin, and along eastern flanks of the Coast Mountains north of the Nass River. The CWHws2 (formerly CWHf2) or Montane Variant, Wet Submaritime Coastal Western Hemlock Subzone occurs between the ICHmc and ICHvc and the ESSFi along the south side of the Cranberry River, both sides of the Kitwanga River, and near the mouth of the Kitseguecla River. The Mountain Hemlock Zone replaces the ESSFi at similar elevations in western portions of the Hazelton and Coast mountains.

The ESSFi has a snowy winter and a moister growing season than the other two ESSF subzones. Mean annual precipitation ranges from 650–1100 mm, and growing season moisture deficits are unlikely. Winter snowpack is typically 1.2–2 m and increases in the western portions of the subzone.

Climax forests of the ESSFi are dominated by subalpine fir with lesser components of mountain hemlock, hybrid spruce, and western hemlock. Lodgepole pine is a rare species. Increased floristic diversity of shrubs and herbs is apparent in the ESSFi relative to the ESSFk, and may be related to heavy snowload and moist, non-frozen soils, as well as to the coast-interior transitional nature of the vegetation.

Ferro-Humic Podzols are the typical zonal soils in the ESSFi. Zonal humus forms of the ESSFi show greater development of H horizons as compared to the F-dominated humus forms of the ESSFk and ESSFl subzones, and are most often classified as Hemihumimors.

3.1.3 ESSFl — Subcontinental Central Subzone

The ESSFl occurs as a narrow (30 km wide at most) band along the leeward, eastern flanks of the Coast Mountains. It also occupies much of the subalpine elevations of the Tahtsa Ranges and portions of the Bulkley Ranges to the south of Telkwa Pass in the Burnie River valley.

Like the western sections of the ESSFi, the ESSFl subzone is characterized by snowy winters (snowpack probably often greater than 2 m). The ESSFl differs from the other

the ESSFl has relatively high annual precipitation (ca 1000 mm) but low summer rainfall.

The combination of dry summers and snowy winters with minimal ground freezing, allows for the growth of mountain hemlock and amabilis fir. Subalpine fir is still the dominant tree of mesic, climax stands. Whitebark pine is also a common and distinctive feature of the ESSFl, particularly on dry, rocky sites. The relatively dry summer climate seems to responsible for the reduced species diversity of the herb and moss layers. Increased presence of *Barbilophozia floerkei* and lichens are characteristic of the ESSFl.

Humus forms tend to be Hemimors and are thin relative to the other ESSF subzones. Zonal soils are predominantly Humo-Ferric Podzols with minimal organic matter accumulation in the mineral horizons.

3.1.4 ESSFkp, ESSFip, ESSFlp: parkland subzones

Parkland subzones lie above and are contiguous with all three forested subzones of the ESSF, and extend upward to timberline. Harsh climate and heavy snowpack do not allow the growth of continuous, productive forests suitable for timber harvesting. More appropriately, interpretations should be developed for recreation and wildlife uses.

The three parkland subzones all contain three main physiognomic classes of vegetation: tree clump, treeless meadow, and treeless heath. Each class has a range of associated moisture and nutrient regimes. Subalpine fir predominates in the mesic treed ecosystems, with characteristic clumpy distribution of stunted trees having a skirt of low branches. Mountain hemlock is common in the tree clumps of the ESSFip and ESSFlp subzones, but is virtually absent from the ESSFkp.

Alpine species such as *Artemisia arctica*, *Cassiope mertensiana*, *Lupinus arcticus* *Castilleja parviflora*, and *Phleum alpinum* are common in all three parkland subzones. Species found in the ESSF subzones of lower elevations are present also.

3.2 Neighbouring Biogeoclimatic Units

The ESSF is an extensive zone that is usually sandwiched between lower and higher elevation zones. Hence, the ESSF touches seven other zones in the Prince Rupert Region. The Alpine Tundra Zone (AT) occupies high elevations above the ESSF. To the west, the ESSF generally meets the AT along the spine of the Coast and Hazelton Mountains. The mountain barrier prevents the ESSF from joining its coastal subalpine counterpart, the Mountain Hemlock Zone (MH), except along a few major corridors such as the Skeena, Nass, Iskut, and Stikine valleys. Furthermore, the western portions of the ESSFi and ESSFl frequently overlie easternmost outliers or lobes of the Coastal Western Hemlock Zone (CWH), especially on the leeward flanks of the Hazelton Mountains and the Tahtsa Ranges. The bulk of the ESSFk lies above the Sub-Boreal Spruce Zone (SBS), whereas the majority of the ESSFi occurs above the Interior Cedar — Hemlock Zone (ICH). To the north, the ESSFk and i encounter both the Boreal White and Black Spruce (BWBS) and Spruce — Willow — Birch (SWB) zones, essentially along the Skeena-Stikine watershed divide. Table 2 (p. 5) outlines some useful floristic distinctions among the ESSF subzones and some of the adjacent biogeoclimatic units.

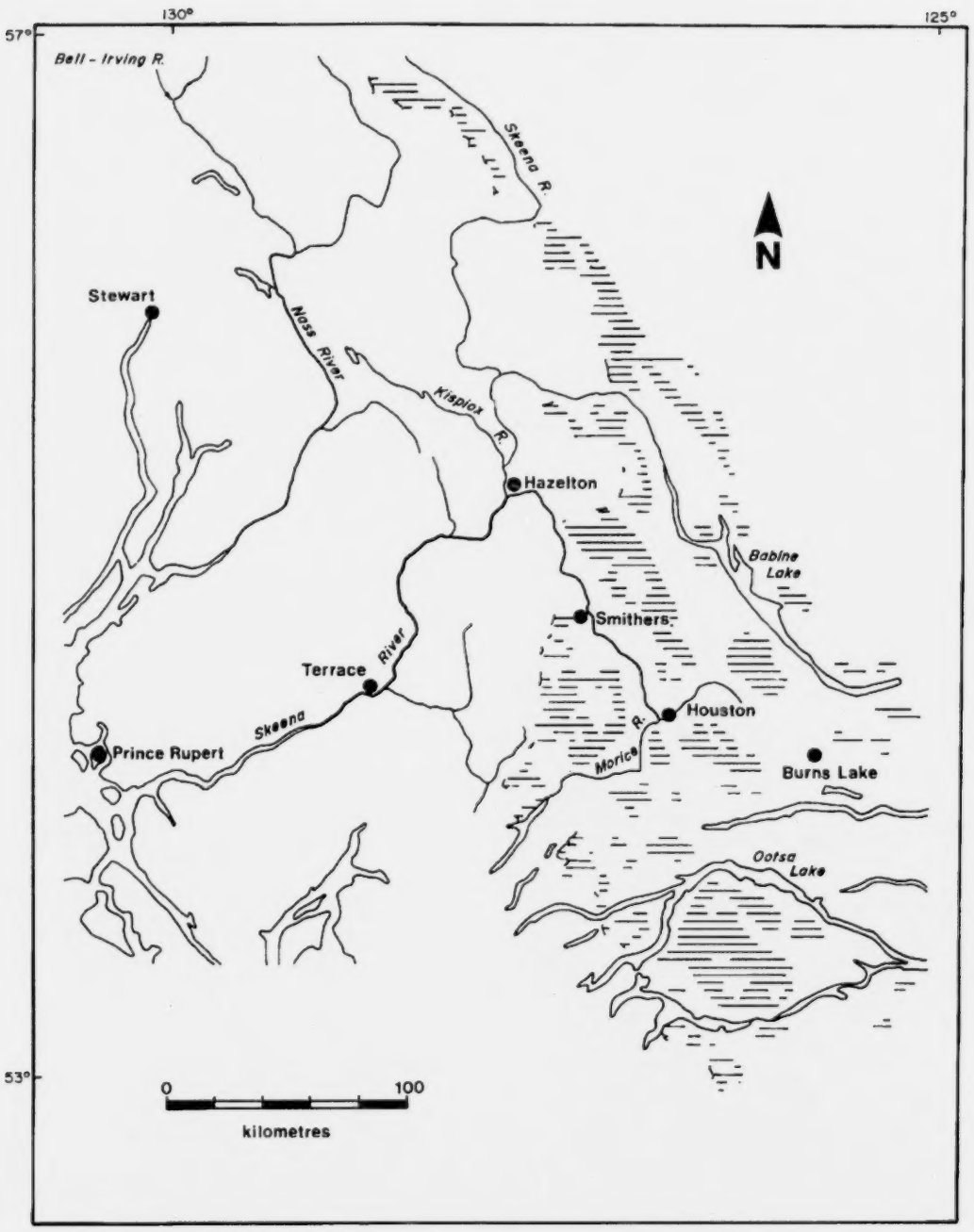


FIGURE 3. The Continental Northern Engelmann Spruce — Subalpine Fir Subzone (ESSFk) in the Prince Rupert Forest Region.

4.1 Site Units of the ESSFk — Continental Northern Subzone

/01 Black Huckleberry — Bunchberry — Moss site series
- /01(a) Medium-textured phase
- /01(b) Fine-textured phase

/02 Pine — Lichen site series
- /02(a) Lithic phase
- /02(b) Glaciofluvial phase

/03 Pine — Lichen — Moss site series
/04 Bunchberry — Moss site series
/05 Thimbleberry — Forb site series
/06 Sitka Valerian — Hellebore site series
/07 Devil's Club site series
/08 Meadow Forest site series
/09 Horsetail site series
/10 Glowmoss site series

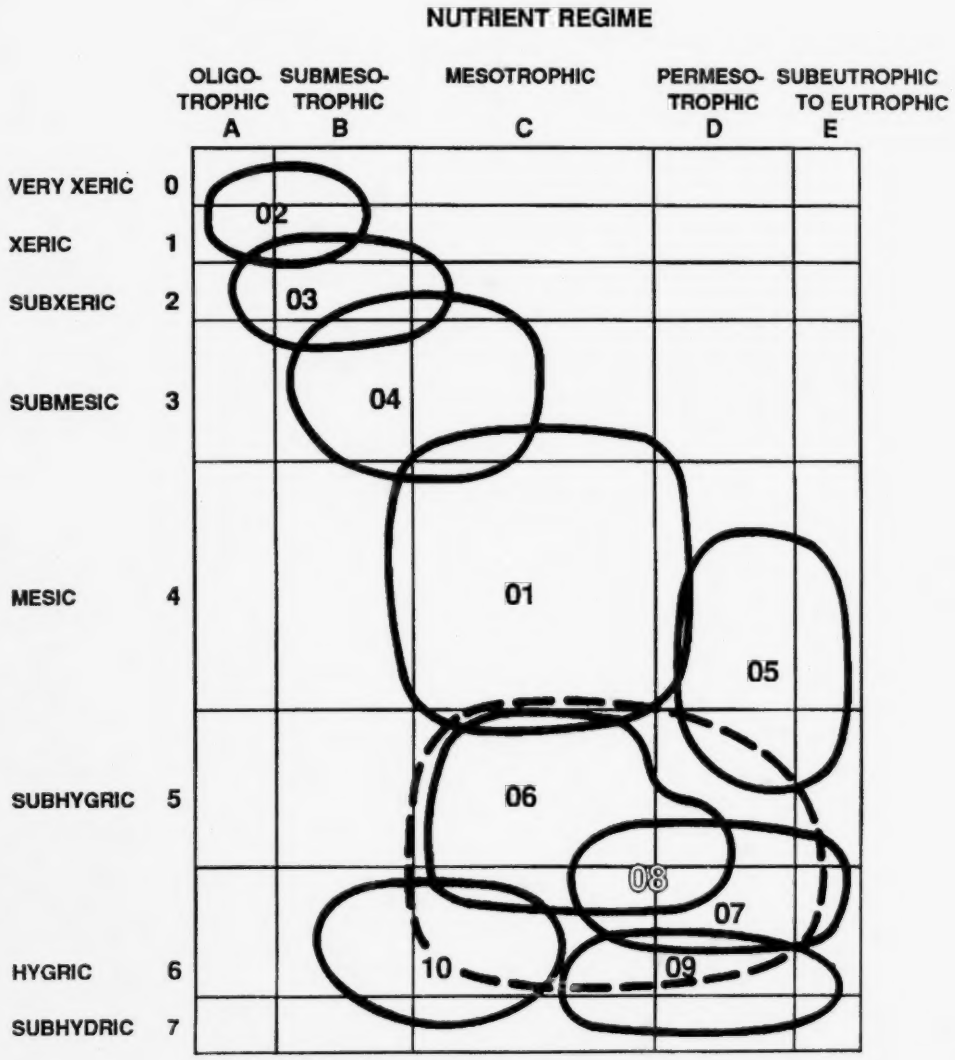


FIGURE 4. Edatopic grid of the ESSFk.

4.2 Key to Site Units of the ESSFk

A Lower to toe slopes; imperfectly to poorly drained sites with water table often present at or near the surface ..... B

AA Upper to lower slopes; rapidly to imperfectly drained sites with water table absent or occasionally present at depth ..... D

B Organic or mineral soils; *Equisetum* spp. dominate herb layer

HORSETAIL (ESSFk/09)

BB Mineral soils; *Equisetum* spp. rare or absent in herb layer C

C Imperfectly to poorly drained sites; surface organic layers usually less than 10 cm thick; *Aulacomnium palustre* infrequent or lacking in moss layer; *Lonicera involucrata* and *Betula glandulosa* usually absent in shrub layers; *Valeriana sitchensis* frequent and *Vaccinium caespitosum* infrequent in herb layer

MEADOW FOREST (ESSFk/08)

CC Poorly drained sites; surface organic layers usually thicker than 10 cm; *A. palustre* frequent in moss layer; *L. involucrata* and *B. glandulosa* common in shrub layers; *V. sitchensis* infrequent and *V. caespitosum* frequent in herb layer

GLOWMOSS (ESSFk/10)

D Upper slopes to crests, or lower slopes on coarse-textured parent materials; rapidly to well-drained sites ..... E

E Lodgepole pine dominates tree canopy; *Vaccinium membranaceum* uncommon in poorly developed shrub layers; lichens dominate moss layer; driest sites in subzone

PINE — LICHEN (ESSFk/02)

(i) Morainal, colluvial veneers overlying bedrock

Lithic phase [ESSFk/02(a)]

(ii) Very coarse-textured glaciofluvial deposits

Glaciofluvial phase [ESSFk/02(b)]

EE Lodgepole pine and/or subalpine fir dominate tree canopy; *Vaccinium membranaceum* common in shrub layers; lichens may be frequent but do not dominate moss layer ..... F

F Generally loamy soils; surface organic layers up to 15 cm thick; lichens uncommon in moss layer

BUNCHBERRY — MOSS (ESSFk/04)

FF Generally sandy soils; surface organic layers usually less than 5 cm thick; lichens frequent and sometimes codominant with mosses and liverworts in moss layer

PINE — LICHEN — MOSS (ESSFk/03)

DD Middle to lower (sometimes toe) slopes; moderately well to imperfectly drained sites G

G Ericaceous species (*Vaccinium membranaceum, V. ovalifolium, Menziesia ferruginea*) dominate the shrub layers ..... H

H Middle to lower slopes; seepage and gleying uncommon or absent; Ah horizon absent; *Cornus canadensis* and *Rubus pedatus* codominate herb layer

BLACK HUCKLEBERRY — BUNCHBERRY — MOSS (ESSFk/01)

(i) Loam to sandy loam texture

Medium-textured phase [ESSFk/01(a)]

(ii) Clay loam to silty clay loam texture

Fine-textured phase [ESSFk/01(b)]

HH Lower and toe slopes; moderately well to imperfectly drained sites; seepage and/or gleying frequent below 40 cm; Ah horizon common; *Valeriana sitchensis, Gymnocarpium dryopteris,* and *Tiarella trifoliata* codominate herb layer

SITKA VALERIAN — HELLEBORE (ESSFk/06)

GG Large-leaved shrubs dominate shrub layers; ericaceous species may be frequent but not dominant (less than 25% total cover) I

I Middle slopes (generally south aspects); moderately well drained sites; seepage and gleying uncommon at depth; well developed Ah layer common; *Rubus parviflorus* dominates shrub layers

THIMBLEBERRY — FORB (ESSFk/05)

II Middle to lower slopes (all aspects); moderately well to imperfectly drained sites; seepage and/or gleying common; Ah horizon infrequent; *Oplopanax horridus* dominates shrub layers

DEVIL'S CLUB (ESSFk/07)

4.3 Description and Interpretation of Site Units of the ESSFk

Selected environmental features associated with the site units are presented in Table 3 (page 16). Table 4 (page 18) summarizes silvicultural interpretations for the ESSFk.

Following these two tables are descriptions and interpretations of the various site units. The small figure in the upper right-hand corner of the descriptive page is an edatopic grid indicating the usual moisture and nutrient conditions for the particular site series. In addition, a small textural triangle outlines the usual range of soil textures found within the site unit. If two soil texture phases are differentiated, they are indicated by black (medium and coarse textures) and white (fine textures) areas.

Species that are present consistently but with low cover, or present inconsistently but with high cover, are enclosed within parentheses. Under the vegetation column, the figures that appear in brackets (e.g., [57]) indicate the average cover of the tree, shrub, herb, or moss layers as extracted from vegetation tables. Layer development may be indicated as sparse (less than 5% total cover), poorly developed (5–15%), moderately developed (15–35%), well developed (35–60%), or very well developed (60%+).

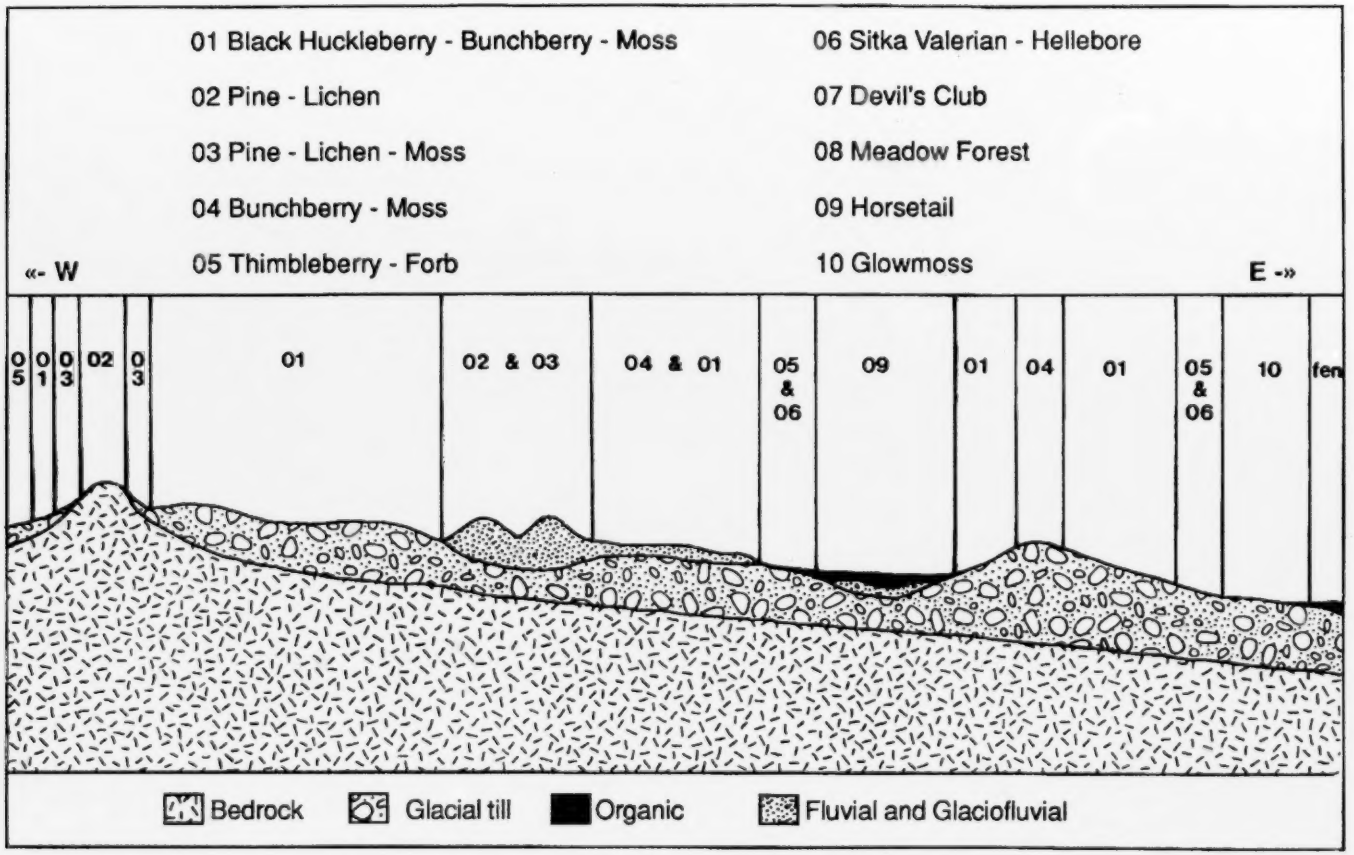


FIGURE 5. Schematic sequence of site series in the ESSFk landscape on the Nechko Plateau.

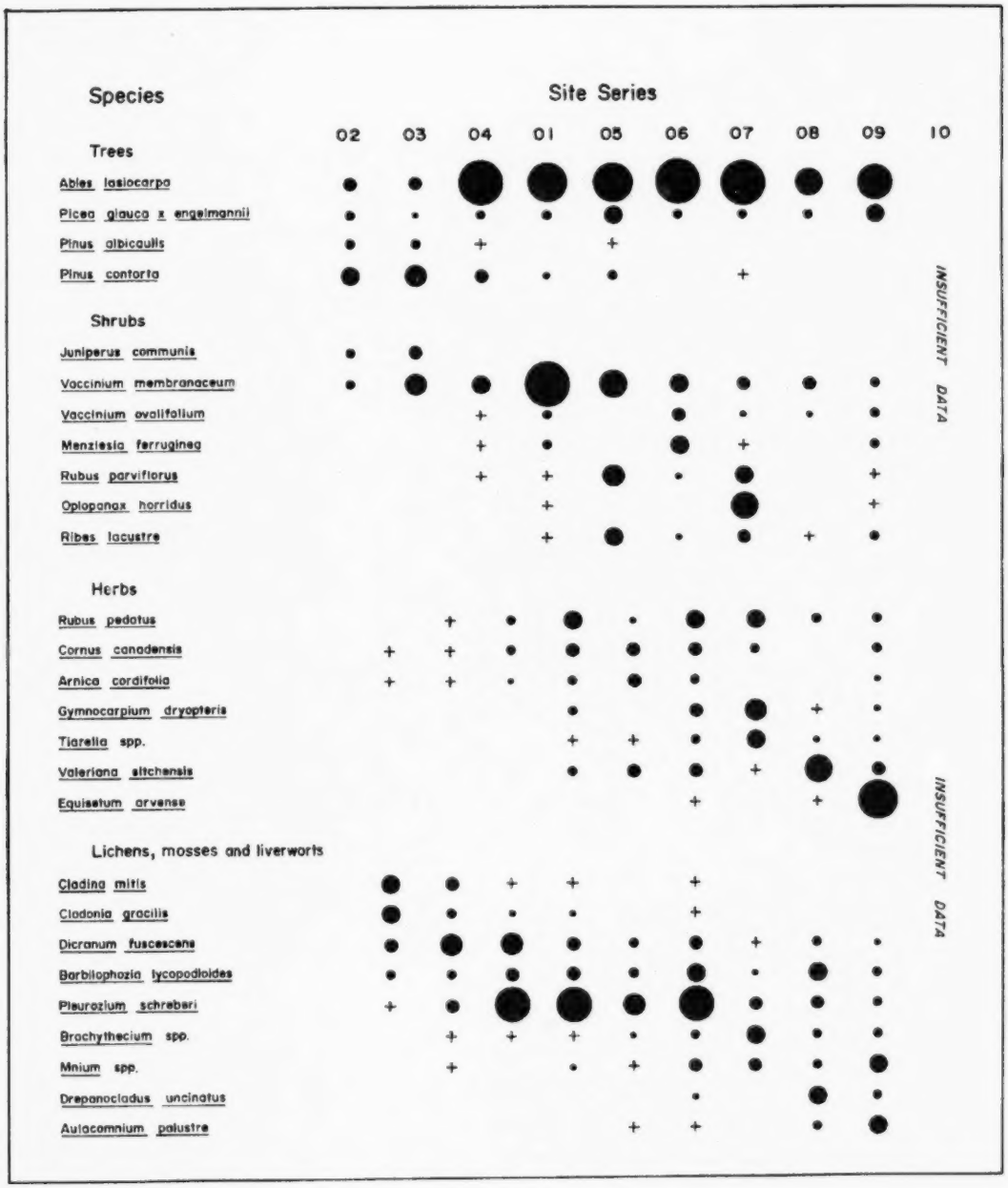


FIGURE 6. Prominence values for major species of the ESSFk.

TABLE 3. Environmental features of site units in the ESSFk

Site unit	Moisture/ nutrient regimes	Slope gradient (%)	Parent materials[a]	Texture[b]	Drainage class
/02 Pine — Lichen	0–1/A-B	0–25			
/02(a) Lithic phase			Mv	LS, S	rapidly
/02(b) Glacio-fluvial phase			FGb	S	rapidly
/03 Pine — Lichen — Moss	1–3/A-C	5–65	Mv/R, Cv/R	SL, LS, S	well-rapidly
/04 Bunchberry-Moss	3/B-C	20–55	M,Cv/R, FGv,FGb	L, SL, S	well
/01 Black Huckleberry — Bunchberry — Moss	4/C	5–30			
/01(a) Medium-textured phase			Mb, Cb	L, SL	mod. well
/01(b) Fine-textured phase			Mb	CL, SiCL	mod. well
/05 Thimbleberry — Forb	4–5/D-E	20–35	Mb	SiL, SCL SL	mod. well
/06 Sitka Valerian — Hellebore	5/C-D	10–45	Mb, Cb	SL, L, CL	mod. well-imperfectly
/07 Devil's Club	5–6/C-E	20–60	Cb, Mb	SiL, L, SL	imperfectly-mod. well
/08 Meadow Forest	5–6/C-D	10–20	Ff, Fb, Mb	SL, L, CL	imperfectly-poorly
/09 Horsetail	6–7/C-E	2–15	Ov, Fb, Mb	SiL, S, organic	poorly-very poorly
/10 Glowmoss	6–7/B-C	2–15	FGv/Mb, Mb	S, L, CL	poorly

TABLE 3 — *Continued*

Site unit	Soilc	Humus formd and depth (cm)	Rooting depthe (cm)	Slope positions
/02 Pine — Lichen	O.HFP	XR 1–2	5–40	crest
/03 Pine — Lichen — Moss	O.HFP	XR, HR 1–5	20–55	upper, crest
/04 Bunchberry — Moss	O.HFP,O.DYB, DU.HFP	HR, (XR) 3–14	30–40	upper
/01 Black Huckleberry — Bunchberry — Moss	O.HFP,DU.HFP, LU.HFP,PZ.GL, BR.GL	HR 3–8	15–75	lower to middle
/05 Thimbleberry Forb	O.SB, O.GL	HR, MMD 15–25	10–25	middle
/06 Sitka Valerian — Hellebore	O.MB, O.HFP, GLPZ.GL	HR, MMD 2–8	20–65	lower to toe
/07 Devil's Club	O.HFP, O.FHP, GLBR.GL	HR, HHR, MMD 5–27	45–65	middle to lower
/08 Meadow Forest	GL.HFP, HU.LG	HR, HUR 2–9	5–30	lower to toe
/09 Horsetail	TY.H, O.G, O.LG	HYR, HMD, HYS 5–100+	0–20	toe
/10 Glowmoss	O.HG, HU.LG	HHR 10+	in humus	lower to toe

a Parent material abbreviations: M — morainal; C — colluvium; FG — glaciofluvial; O — organic; F — fluvial; R — bedrock; v — veneer; b — blanket; f — fan.

b Texture abbreviations: S — sand; LS — loamy sand; SL — sandy loam; L — loam; CL — clay loam; SiL — silt loam; SiCL — silty clay loam; SCL — sandy clay loam.

c Abbreviations of soil classification: O.HFP — Orthic Humo-Ferric Podzols; DU.HFP — Duric Humo-Ferric Podzols; GL.HFP — Gleyed Humo-Ferric Podzols; O.SB — Orthic Sombric Brunisols; O.MB — Orthic Melanic Brunisols; EL.DYB — Eluviated Dystric Brunisols; O.GL — Orthic Gray Luvisols; BR.GL — Brunisolic Gray Luvisols; PZ.GL — Podzolic Gray Luvisols; GLPZ.GL — Gleyed Podzolic Gray Luvisols; GLBR.GL — Gleyed Brunisolic Gray Luvisols; HU.LG — Humic Luvic Gleysols; O.LG — Orthic Luvic Gleysols; O.G — Orthic Gleysols; O.HG — Orthic Humic Gleysols; TY.H — Typic Humisols.

d Abbreviations of humus form classification: HR — Hemimors; HHR — Hemihumimors; HUR — Humimors; XR — Xeromors; MMD — Mormoders; HYR — Hydromors; HMD — Histomoders; HYS — Hydrosaprimulls.

e Rooting depth measured from organic/mineral interface.

TABLE 4. Summary of silvicultural prescriptions and guidelines for the ESSFk

Site unit	Season of logging	Site preperation Mech.	Burning	Species choice[a] Pref.	Accept.	Brush potential
/02	A V O I D L O G G I N G				Pl	very low
/03	A V O I D L O G G I N G				Pl	very low
/04	summer	OK	AVOID	Pl	Sxw	very low
/01						
/01(a)	summer or winter	OK	OK	Pl (Sxw[b])	Bl	low
/01(b)	late summer or fall	OK	OK	Sxw[b] (Pl)	Bl	low
/05	late summer or winter	OK	OK	Sxw[b], Pl[c]	Bl	moderate to high
/06	winter	OK[d]	OK	Sxw[b]	Bl, Pl[c]	moderate
/07	winter	OK[d]	OK	Sxw[b]	Bl	high
/08	winter[e]	AVOID	AVOID	Sxw[b]	Bl	low
/09	winter	OK[d]	OK	Sxw[b]	Bl	very high
/10	winter	OK[d]	OK	Sxw[b]	Bl	low

[a] A preferred species for a managed forest is ecologically appropriate to the site and best suited to management objectives. An acceptable species is ecologically appropriate but less suited to management objectives.

[b] Sxw not preferred (but still acceptable) in stands with incidence of tomentose root rot and unacceptable within infection centres. Replace with other preferred/acceptable species as required.

[c] On coarse-textured soils, generally Podzols.

[d] Mechanical site preparation should be done during the driest portions of the year or after soils have frozen.

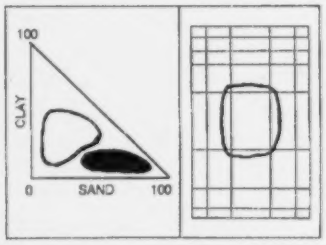
[e] Due to limited productivity of these sites, selective logging should be practiced where possible or logging avoided.

BLACK HUCKLEBERRY — BUNCHBERRY — MOSS (ESSFk/01)

SLOPE POSITION: Lower to middle slopes

SLOPE GRADIENT: 5–30%

ASPECT: All



VEGETATION LAYERS	SOILS	
	Medium-textured phase [ESSFk/01(a)]	**Fine-textured phase [ESSFk/01(b)]**
TREE [50]: Fairly well stocked,fair to good growth for the subzone. Bl (Sxw)	LANDFORM: Morainal and colluvial blankets; glaciofluvial veneers.	Morainal blankets.
SHRUB [59]: Moderately to well developed. *Vaccinium membranaceum* *(Menziesia ferruginea)* *(Vaccinium ovalifolium)*	TEXTURE: Loam and sandy loam.	Clay loam to silty clay loam.
	DRAINAGE: Moderately good.	Moderately good.
HERB [35]: Moderately well developed. *Cornus canadensis* *Rubus pedatus* *Orthilia secunda* *Arnica cordifolia* *Valeriana sitchensis* *(Streptopus* spp.) *(Lycopodium annotinum)* *(Veratrum viride)*	EFFECTIVE ROOTING: 25–75 cm.	15–35 cm.
	SOIL NAME: Orthic and Duric Humo-Ferric Podzols.	Luvisolic Humo-Ferric Podzols; Brunisolic and Podzolic Gray Luvisols.
	HUMUS FORM AND DEPTH: Hemimors. 2–7 cm.	Hemimors. 3–8 cm.
MOSS [70]: Generally well developed. *Pleurozium schreberi* *Dicranum* spp. *Cladonia* spp. *Peltigera* spp. *Barbilophozia lycopodioides*	OTHER FEATURES: Hardpan (duric) horizons may restrict rooting.	Fine-textured horizons may restrict rooting.

COMMENTS: Widespread at mid-slope positions throughout the ESSFk. The most common and abundant site series in the subzone.

BLACK HUCKLEBERRY — BUNCHBERRY — MOSS (ESSFk/01)

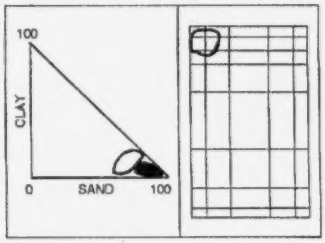
ACTIVITY OR CONCERN	Medium-textured phase [ESSFk/01(a)]	Fine-textured phase [ESSFk/01(b)]
Species choice:		
Preferred	— Pl,(Sxw).	— Sxw, (Pl).
Acceptable	— Bl	— Bl
Logging:	— summer or winter	— late summer or fall. — possible soil compaction if logged too early when soils are wet. — possible windfall hazard if rooting restricted; adjust block layout if necessary.
Site preparation:		
Mechanical	— OK. — avoid scalping.	— OK. — if scraping or scalping, avoid planting in depressions or gouges; plant on micro-mounds.
Prescribed fire	— OK, USE CAUTION. — very light burns on coarse soils. — aim for a light intensity burn that consumes fine and medium fuels, litter, and 20–30% of the F horizon of humus.	
Brush hazard:	— generally low. — may increase following excessive disturbance. — when *Vaccinium* species dominate, planter access and seedling establishment may be restricted.	
Reforestation:	— plant Pl (or Sxw) — use plugs in coarse rocky soils.	— plant Sxw (or Pl).
Other comments:		— beware frost heaving in non-insulated (i.e., with surface organic layers removed) silty soils.

PINE — LICHEN (ESSFk/02)

SLOPE POSITIONS: Crest, upper slope

SLOPE GRADIENT: 0–25%

ASPECT: N/A



VEGETATION LAYERS	SOILS	
	Lithic phase [ESSFk/02(a)]	**Glaciofluvial phase [ESSFk/02(b)]**
TREE [26]: Open, poorly growing stands. Pl Bl (Sxw) (Pa)	PARENT MATERIAL: Morainal veneers, and residual weathered materials.	Glaciofluvial blankets.
SHRUB [14]: Poorly developed; regen. of Pl, Bl, Sxe, Pa. *Juniperus communis* *Vaccinium membranaceum*	TEXTURE: Loamy sands.	Sands.
	DRAINAGE: Rapid.	Rapid.
HERB [7]: Sparse to poorly developed. *Empetrum nigrum* *Cornus canadensis* *Vaccinium caespitosum* (*Arctostaphlos uva-ursi*) (*Saxifraga tricuspidata*) (*Antennaria* spp.)	EFFECTIVE ROOTING: 5 cm.	40 cm.
	SOIL NAME: Orthic Humo-Ferric Podzols.	Orthic Humo-Ferric Podzols.
MOSS [54]: Well developed. *Cladonia* spp. *Cladina mitis* *Dicranum fuscescens* *Peltigera* spp. (*Polytrichum* spp.)	HUMUS FORM AND DEPTH: Velomoders. 1–5 cm.	Xeromors. 1–5 cm.
	OTHER FEATURES: Dry rocky sites, skeletal soils; usually associated with bedrock outcrops.	75% coarse fragment content; mainly gravels.

COMMENTS: These sites have very low productivity because of limited soil volumes (shallow over bedrock) or very coarse gravelly soils that are unable to retain much moisture or nutrients. Both phases are uncommon and rarely extensive in the ESSFk.

PINE — LICHEN (ESSFk/02)

ACTIVITY OR CONCERN

AVOID LOGGING

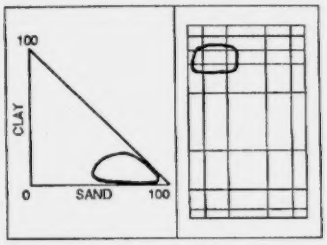
These ecosystems are marginal for timber production. If they are included within larger openings, then consider their harvesting as timber mining. The coarse-textured Glaciofluvial phase [ESSFk/02(b)] could be useful as a gravel source for road building, but could also be important winter habitat for mountain caribou in some areas. If necessary, plant Pl plugs.

PINE — LICHEN — MOSS (ESSFk/03)

SLOPE POSITIONS: Upper to crest

SLOPE GRADIENT: Upper slopes: 15–65%
Crest: 5–15%

ASPECT: Primarily south



VEGETATION LAYERS

TREE [70]: Small trees of low vigour; open to dense.
- Pl
- Bl
- (Sxw)
- (Pa)

SHRUB [20]: Poorly to moderately developed; considerable advance regen. of all conifer species.
- *Vaccinium membranaceum*
- (*Juniperus communis*)
- (*Sorbus sitchensis*)
- (*Sorbus scopulina*)

HERB [10]: Sparse to poorly developed; low diversity.
- *Empetrum nigrum*
- *Cornus canadensis*
- (*Arnica cordifolia*)
- (*Orthilia secunda*)
- (*Vaccinium caespitosum*)

MOSS [25]: Poorly to moderately developed with considerable lichen cover.
- *Dicranum* spp.
- *Barbilophozia* spp.
- *Peltigera* spp.
- *Pleurozium schreberi*
- *Cladonia* spp.

SOILS

LANDFORM:
Morainal and colluvial veneers overlying bedrock.

TEXTURE:
Coarse loams, sands.

DRAINAGE:
Good to rapid.

EFFECTIVE ROOTING:
20–55 cm = depth to bedrock.

SOIL NAME:
Orthic and Duric Humo-Ferric Podzols.

HUMUS FORM AND DEPTH:
Xeromors; Hemimors.
1–5 cm.

OTHER FEATURES:
Hardpan and/or bedrock often within 50 cm of surface; bright-coloured Bf horizon present; very thin humus layer; soil often stony.

COMMENTS: A relatively uncommon and local site series.

PINE — LICHEN — MOSS (ESSFk/03)

ACTIVITY OR CONCERN
AVOID LOGGING

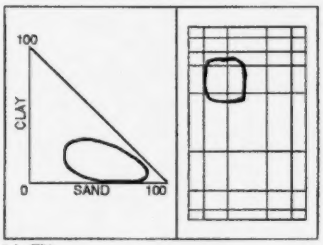
These ecosystems are marginal for timber production. If they are included within larger openings, then consider their harvesting as timber mining. Coarse-textured parent materials often found on this site series may be a useful source of gravel for road building. However, such sites may be important winter range for mountain caribou in some areas. If necessary, plant Pl plugs.

BUNCHBERRY — MOSS (ESSFk/04)

SLOPE POSITIONS: Predominantly upper slopes; crests of gentle knolls

SLOPE GRADIENT: 20–55%

ASPECT: East to south



VEGETATION LAYERS

TREE [53]: Open stands of moderate to poor growth.
- Bl
- (Pl)
- (Sxw)

SHRUB [33]: Moderately developed; abundant Bl advance regeneration.
- *Vaccinium membranaceum*
- (*Sorbus scopulina*)
- (*Sorbus sitchensis*)
- (*Alnus viridis* ssp. *sinuata*)

HERB [15]: poorly developed, low diversity.
- *Cornus canadensis*
- *Orthilia secunda*
- *Rubus pedatus*
- *Arnica cordifolia*
- *Vaccinium caespitosum*
- (*Linnaea borealis*)

MOSS [60]: Well developed.
- *Dicranum fuscescens*
- *Pleurozium schreberi*
- *Barbilophozia lycopodioides*
- *Peltigera* spp.
- *Cladonia* spp.

SOILS

LANDFORM:
Morainal and colluvial veneers and blankets; glaciofluvial veneers and blankets.

TEXTURE:
Loam, sandy loam, loamy sand.

DRAINAGE:
Good.

EFFECTIVE ROOTING:
30–40 cm.

SOIL NAME:
Orthic and Duric Humo-Ferric Podzols; Dystric Brunisols.

HUMUS FORM AND DEPTH:
Hemimors; (Xeromors).
3–14 cm.

OTHER FEATURES:
Hardpan and/or bedrock often found within 50 cm of soil surface.

COMMENTS: Common but much less extensive than the mesic site series. Generally shallower soils than mesic series. Upper slope positions combined with coarse-textured mineral soils may result in moisture deficits in humus and upper mineral layers.

BUNCHBERRY — MOSS (ESSFk/04)

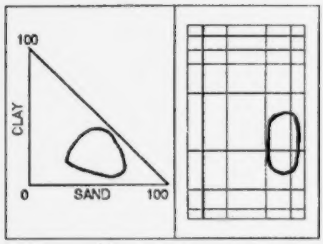
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Pl
Acceptable	— Sxw
Logging:	— summer log when possible to help incorporate organic matter into mineral soil. — watch for susceptibility to windthrow in shallow soils; adjust block layout if necessary.
Site preparation:	
Mechanical	— OK. — preferable to burning for reducing fire hazard and incorporating organic matter into soils.
Prescribed fire	— DO NOT BURN. — loss of organic matter will reduce site productivity.
Brush hazard:	— very low.
Reforestation:	— plant Pl. — use plugs on rocky soils.

THIMBLEBERRY — FORB (ESSFk/05)

SLOPE POSITIONS: **Middle (lower if upslope distance is short)**

SLOPE GRADIENT: **20–35%**

ASPECT: **South**



VEGETATION LAYERS

TREES [55]: Better than average growth for the subzone.
- Bl
- Sxw
- (Pl)

SHRUB [77]: Very well developed; abundant advance regen. of Bl.
- *Rubus parviflorus*
- *Vaccinium membranaceum*
- *Ribes lacustre*
- *Viburnum edule*
- *Alnus viridis* ssp. *sinuata*

HERB [48]: Well developed and diverse.
- *Arnica cordifolia*
- *Streptopus roseus*
- *Cornus canadensis*
- *Valeriana sitchensis*
- *Smilacina racemosa*
- *Thalictrum occidentale*
- (*Veratrum viride*)

MOSS [45]: Well developed.
- *Pleurozium schreberi*
- *Barbilophozia lycopodioides*
- *Dicranum* spp.
- *Brachythecium* spp.
- *Rhytidiopsis robusta*

SOILS

LANDFORM:
Morainal blankets.

TEXTURE:
Fine loam, sandy clay loam, fine sandy loam.

DRAINAGE:
Moderately good.

EFFECTIVE ROOTING:
10–25 cm.

SOIL NAME:
Orthic Sombric Brunisols; Orthic Gray Brown Luvisols.

HUMUS FORM AND DEPTH:
Hemimors; Mormoders. 15–25 cm.

OTHER FEATURES:
Moist, fairly deep (60–100 cm) soils with considerable organic matter incorporation in Ah; seepage may occur at depth; relatively high pH in mineral (5.6–6.0) and organic (4.0–5.8) horizons. Ah horizon equals 40% of humus form.

COMMENTS: Restricted distribution of this unit is governed by the location of base-rich (high pH) parent materials. Formation of dark-coloured mineral soils is characteristic. This series is part of a site association that is much more widespread in the adjoining SBSmc subzone.

THIMBLEBERRY — FORB (ESSFk/05)

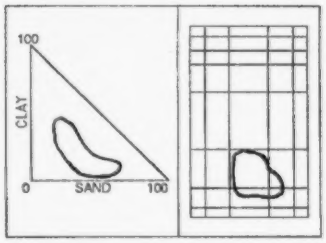
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sxw; Pl also, on coarse soils.
Acceptable	— Bl
Logging:	— log in late summer, where possible, to promote organic matter incorporation into mineral soil. — if finer-textured soils, winter log to avoid compaction.
Site preparation:	
Mechanical	— OK. — conduct during dry periods to minimize brush establishment. — following scraping or scalping plant on edges or on mounds rather than in depressions.
Prescribed fire	— OK. — medium or low intensity burns on sites not having an Ah horizon.
Brush hazard:	— moderate to high. — plan for one maintenance treatment; assess at time of planting.
Reforestation:	— plant with Sxw. — plant Pl on coarse-textured soils.
Other comments:	— fair potential for domestic range.

SITKA VALERIAN — HELLEBORE (ESSFk/06)

SLOPE POSITIONS: Lower to toe slope

SLOPE GRADIENT: 10–45%

ASPECT: All



VEGETATION LAYERS

TREE [53]: Open stands with good growth.
- Bl
- (Sxw)
- (Pl)

SHRUB [55]: Well to very well developed, diverse, vigorous; abundant advance regen. of Bl, (Sxw).
- *Vaccinium membranaceum*
- *Vaccinium ovalifolium*
- *Ribes lacustre*
- *Sorbus* spp.
- (*Menziesia ferruginea*)
- (*Alnus viridis* ssp. *sinuata*)

HERB [50]: Well to very well developed; diverse.
- *Gymnocarpium dryopteris*
- *Tiarella* spp.
- *Valeriana sitchensis*
- *Veratrum viride*
- *Lycopodium annotinum*
- *Rubus pedatus*
- *Cornus canadensis*

MOSS [69]: Very well developed; leafy mosses (*Mnium* spp.) common.
- *Mnium* spp.
- *Pleurozium schreberi*
- *Dicranum fuscescens*
- *Barbilophozia lycopodioides*
- *Peltigera* spp.

SOILS

LANDFORM:
Washed morainal blankets and colluvial blankets, fluvial fans or aprons.

TEXTURE:
Sandy loam, loam, clay loam.

DRAINAGE:
Moderately good to imperfect.

EFFECTIVE ROOTING:
20–65 cm.

SOIL NAME:
Orthic Melanic Brunisols; Gleyed Podzolic Gray Luvisols; Orthic Humo-Ferric Podzols.

HUMUS FORM AND DEPTH:
Hemimors; Mormoders.
2–8 cm.

OTHER FEATURES:
Abundant seepage and/or gleying common below 40 cm; Ah horizon common; freely drained surface horizons with low coarse fragment content.

COMMENTS: Relatively productive site series that may appear similar to the Moist Thimbleberry — Forb, particularly in a seral state. However, the relative abundance of *Gymnocarpium dryopteris* is diagnostic for the /06. Mottling is common and surface mineral horizons are usually dark in colour.

SITKA VALERIAN — HELLEBORE (ESSFk/06)

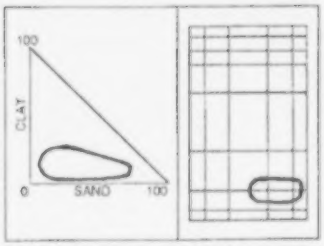
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sxw.
Acceptable	— Bl; Pl also, on coarse soils.
Logging:	— winter logging preferred to minimize brush competition and soil compaction. — avoid logging when soils are wet.
Site preparation:	
Mechanical	— OK, but it could increase brush competition (sprouting, fragmented roots). — good alternative to burning to provide planter access.
Prescribed fire	— OK. — medium or low intensity burns on sites not having an Ah horizon. — burn intensity less critical to nutrient pool of sites having a significant Ah horizon.
Brush hazard:	— moderate. — plan for one maintenance treatment; assess at time of planting or preharvest silviculture assessment.
Reforestation:	— plant Sxw. — plant vigorous stock on elevated mounds where possible.

DEVIL'S CLUB (ESSFk/07)

SLOPE POSITIONS: Middle to lower slope

SLOPE GRADIENT: 20–60%

ASPECT: All



VEGETATION LAYERS

TREE [60]: Productive stands.
Bl
(Sxw)
(Pl)

SHRUB [64]: Well developed; abundant Bl, minor Sxw advance regeneration.
Oplopanax horridus
Alnus viridis ssp. *sinuata*
Rubus parviflorus
Ribes lacustre
Vaccinium membranaceum
(*Viburnum edule*)

HERB [72]: Well to very well developed and diverse.
Gymnocarpium dryopteris
Tiarella trifoliata
Actaea rubra
Streptopus amplexifolius
Galium triflorum
Veratrum viride
Rubus pedatus
Clintonia uniflora
Cornus canadensis

MOSS [72]: Very well developed, leafy mosses dominate.
Mnium spp.
Brachythecium spp.
(*Pleurozium schreberi*)
(*Barbilophozia lycopodioides*)
(*Ptilium crista — castrensis*)

SOILS

LANDFORM:
Colluvial and morainal blankets.

TEXTURE:
Silt loam, loam, sandy loam.

DRAINAGE:
Moderately good to imperfect.

EFFECTIVE ROOTING:
45–60 cm.

SOIL NAME:
Orthic Humo-Ferric and Ferro-Humic Podzols; Orthic Dystric Brunisols; Gleyed Brunisolic Gray Luvisols.

HUMUS FORM AND DEPTH:
Hemimors; Hemihumimors; Mormoders.
5–27 cm.

OTHER FEATURES:
Porous soils with seepage in lower horizons; evidence of faunal activity in mineral and organic horizons.

COMMENTS: The most productive site series of the ESSFk although not widespread. Mainly occurs on steep mountainous slopes on the western edges of the Nechako Plateau, and mostly in the lower portions of the subzone. Fertile soil with continuous input of nutrients from flowing seepage waters.

DEVIL'S CLUB (ESSFk/07)

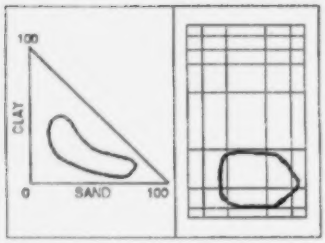
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sxw.
Acceptable	— Bl.
Logging:	— winter logging preferred to minimize brush colonization and soil compaction. — minimize disturbance on steep slopes.
Site preparation:	
Mechanical	— OK, with caution, to avoid excessive erosion or brushing-in. — conduct during dry periods to avoid brush establishment. — avoid excessive exposure of mineral soil. — create plantable spots or mounds where possible.
Prescribed fire	— OK. — will TEMPORARILY reduce brush problem. — preferable to mechanical treatment (less brush, less erosion).
Brush hazard:	— high or very high. — plantation maintenance likely required to reduce brush competition.
Reforestation:	— PLANT VIGOROUS Sxw IMMEDIATELY after site preparation. — plant on edge of scarified patch or on mounds to keep roots above water table.

MEADOW FOREST (ESSFk/08)

SLOPE POSITIONS: Lower and toe slopes

SLOPE GRADIENT: 10–20%

ASPECT: All



VEGETATION LAYERS

TREE [44]: Clumped distribution of trees.
Bl
(Sxw)

SHRUB [33]: Moderately developed but with plentiful Bl advance regeneration.
Vaccinium membranaceum
Vaccinium ovalifolium

HERB [50]: Moderately to well developed, especially in openings; diverse.
Valeriana sitchensis
Veratrum viride
Senecio triangularis
Parnassia fimbriata
Sanguisorba canadensis
Arnica cordifolia
Tiarella spp.
Mitella spp.
Rubus pedatus

MOSS [80]: Very well developed; leafy mosses abundant.
Drepanocladus uncinatus
Mnium spp.
Barbilophozia spp.
(*Aulacomnium palustre*)
(*Pleurozium schreberi*)
(*Dicranum fuscescens*)

SOILS

LANDFORM:
Fluvial fans and blankets, morainal blankets.

TEXTURE:
Sandy loam, loam, clay loam.

DRAINAGE:
Imperfect to poor.

EFFECTIVE ROOTING:
5–30 cm.

SOIL NAME:
Gleyed Humo-Ferric Podzols; Humic Luvic Gleysols.

HUMUS FORM AND DEPTH:
Hemimors; Humimors.
2–10 cm.

OTHER FEATURES:
Seepage and or gleying common; surface slope-wash common; excessive moisture and/or compacted till may restrict rooting at depths below 50 cm; relatively heavy snowload.

COMMENTS: The Meadow Forest site series is widespread at upper elevations of the ESSFk and represents a transition to the parkland subzone. Typically these stands have open, irregular canopies with patches of trees and herb-rich glades. These sites have low timber productivity but share several species with the more productive ESSFk/06 (Valerian — Hellebore) of lower elevations. Low soil temperatures and harsh climate may restrict forest growth. Soils are very moist for the majority of the growing season.

MEADOW FOREST (ESSFk/08)

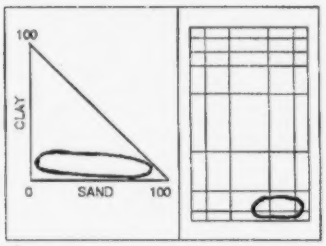
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sxw.
Acceptable	— Bl.
Logging:	— winter logging preferred to minimize soil compaction and improve trafficabilty. — preserve natural regeneration by selective logging.
Site preparation:	
Mechanical	— AVOID.
Prescribed fire	— AVOID.
Brush hazard:	— low.
Reforestation:	— planting check expected because of climatic extremes and frost damage. — plant Sxw where extensive areas of this unit are logged.
Other comments:	— these ecosystems are marginal for timber production and subsequent forest establishment; minimal regeneration survival is expected if clearcut logging is practiced.

HORSETAIL (ESSFk/09)

SLOPE POSITIONS: Toe slopes

SLOPE GRADIENT: Generally 2–15%

ASPECT: Generally not applicable



VEGETATION LAYERS

TREE [38]: Open stands.
- Bl
- Sxw

SHRUB [38]: Poorly to moderately developed; abundant advance regen. of Bl.
- *Ribes lacustre*
- *Vaccinium membranaceum*
- (*Lonicera involucrata*)
- (*Vaccinium ovalifolium*)
- (*Menziesia ferruginea*)

HERB [80]: Very well developed; diverse; horsetails prominent.
- *Equisetum arvense*
- *Tiarella* spp.
- *Valeriana sitchensis*
- *Parnassia fimbriata*
- *Senecio triangularis*
- *Arnica cordifolia*
- *Cornus canadensis*
- *Rubus pedatus*
- (*Sanguisorba canadensis*)

MOSS [90]: Dominated by leafy mosses.
- *Mnium* spp.
- *Aulacomnium palustre*
- *Drepanocladus uncinatus*
- *Brachythecium* spp.

SOILS

LANDFORM:
Morainal, fluvial blankets often overlain by wet organic veneer.

TEXTURE:
Variable; sand, silt loam, or organic material.

DRAINAGE:
Poor (very poor).

EFFECTIVE ROOTING:
0–20 cm (conifer roots at or near surface).

SOIL NAME:
Mesisols; Humisols; Orthic Luvic Gleysols; Orthic Gleysols.

HUMUS FORM AND DEPTH:
Hydromors; Histomoders; Hydrosaprimulls.
5–100+ cm.

OTHER FEATURES:
Wet sites with elevated hummocks common; seepage near surface year-round; dull-coloured, gleyed mineral horizons overlain by wet, mushy organics.

COMMENTS: Common sites of toe slope positions. Although soil is nutrient-rich, high water table and poor aeration for long periods result in poor forest productivity.

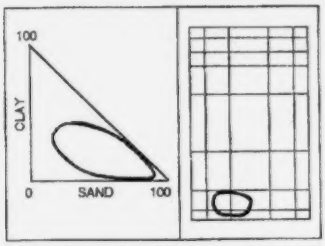
HORSETAIL (ESSFk/09)

ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sxw.
Acceptable	— Bl.
Logging:	— WINTER LOG ONLY, to minimize brush competition and trafficability problems associated with wet, mucky soils. — selective logging may be a viable alternative. — if these sites are small, their timber can often be extracted from outside the unit.
Site preparation:	
Mechanical	— OK, with caution, to avoid promoting brush. — creating or maintaining mounds will improve soil temperature and moisture conditions adjacent to rooting zone.
Prescribed fire	— OK, but difficult because wet conditions would not allow a fire to carry well. — may be useful for species conversion.
Brush hazard:	— expect strong to severe brush competition following logging.
Reforestation:	— PLANT Sxw IMMEDIATELY ON MOUNDS USING LARGE VIGOROUS STOCK. — AVOID PLANTING IN DEPRESSIONS. — beware frost heaving in silty soils.

GLOWMOSS (ESSFk/10)

SLOPE POSITIONS: Lower and toe slopes

SLOPE GRADIENT: 2–15%



VEGETATION LAYERS	SOILS
TREES [41]: Bl Sxw (Pl)	LANDFORM: Morainal blankets, glaciofluvial veneers over morainal blankets.
SHRUB [23]: Poorly developed; plentiful Bl advance regeneration. *Lonicera involucrata* *Vaccinium membranaceum* (*Betula glandulosa*) (*Salix* spp.)	TEXTURE: Variable; sandy skeletal to clay loam. DRAINAGE: Poor.
HERB [43]: Well developed. *Vaccinium caespitosum* *Empetrum nigrum* *Erigeron peregrinus* *Artemisia arctica* *Equisetum scirpoides* *Trisetum cernuum* *Senecio triangularis* *Calamagrostis canadensis* *Sanguisorba canadensis*	EFFECTIVE ROOTING: In humus. SOIL NAME: Orthic Humic Gleysols; Humic Luvic Gleysols. HUMUS FORM AND DEPTH: Hemihumimors. 10+ cm.
MOSS [85]: Glowmoss (*Aulacomnium palustre*) is a significant component of the well-developed moss layer. *Aulacomnium palustre* *Drepanocladus uncinatus* (*Tomenthypnum nitens*) (*Sphagnum capillaceum*) (*Pleurozium schreberi*) (*Peltigera aphthosa*)	OTHER FEATURES: Wet, cold soils with seepage within 50 cm of the surface.

COMMENTS: Not widespread; usually found on gentle slopes surrounding non-forested wetlands (fens) of the Nechako Plateau. A low productivity, wet site series with a mosaic of wet and mesic indicator species occurring in depressions or on elevated hummocks, respectively.

GLOWMOSS (ESSFk/10)

ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sxw.
Acceptable	— Bl.
Logging:	— winter log only to minimize trafficability problems on these wet sites. — selective logging may be a viable alternative.
Site preparation:	
Mechanical	— OK. — maintaining natural mounds may improve chances for seedling survival.
Prescribed fire	— OK, but not recommended. — may be useful for species conversion. — wet conditions would not allow a fire to carry well.
Brush hazard:	— low.
Reforestation:	— plant Sxw on mounds, including mounds of decayed wood.
Other comments:	— these are low productivity sites that are marginal for timber production.

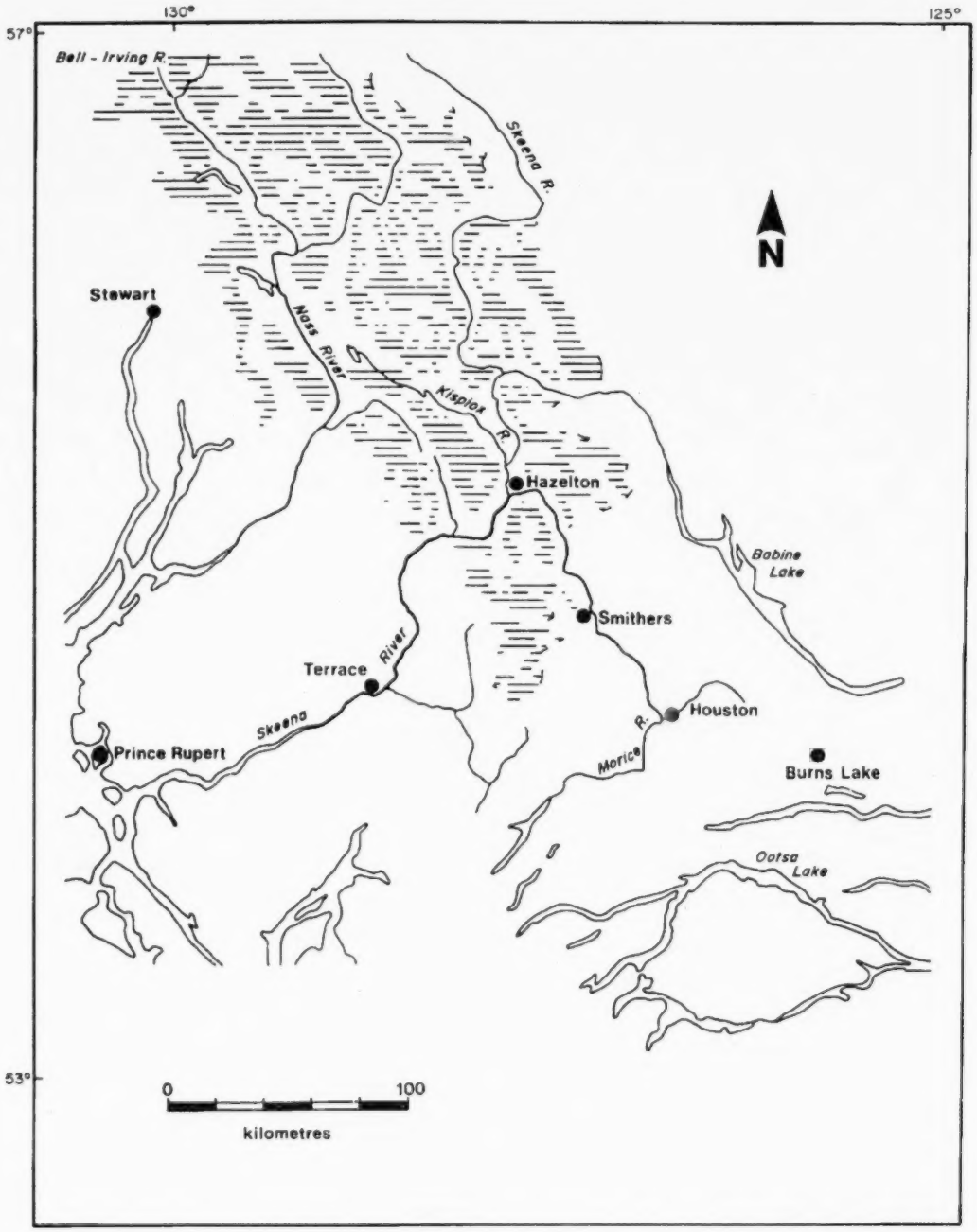


FIGURE 7. The Subcontinental Northern Engelmann Spruce — Subalpine Fir Subzone (ESSFi) in the Prince Rupert Forest Region.

5.1 Site Units of the ESSFi — Subcontinental Northern Subzone.

/01 Huckleberry — Bunchberry — Moss site series
/02 Lichen — Moss site series
/03 Subalpine Fir — Moss site series
/04 Mountain Hemlock — Moss site series
/05 Oak Fern site series
/06 Devil's Club site series
/07 Meadow Forest site series
/08 Horsetail site series

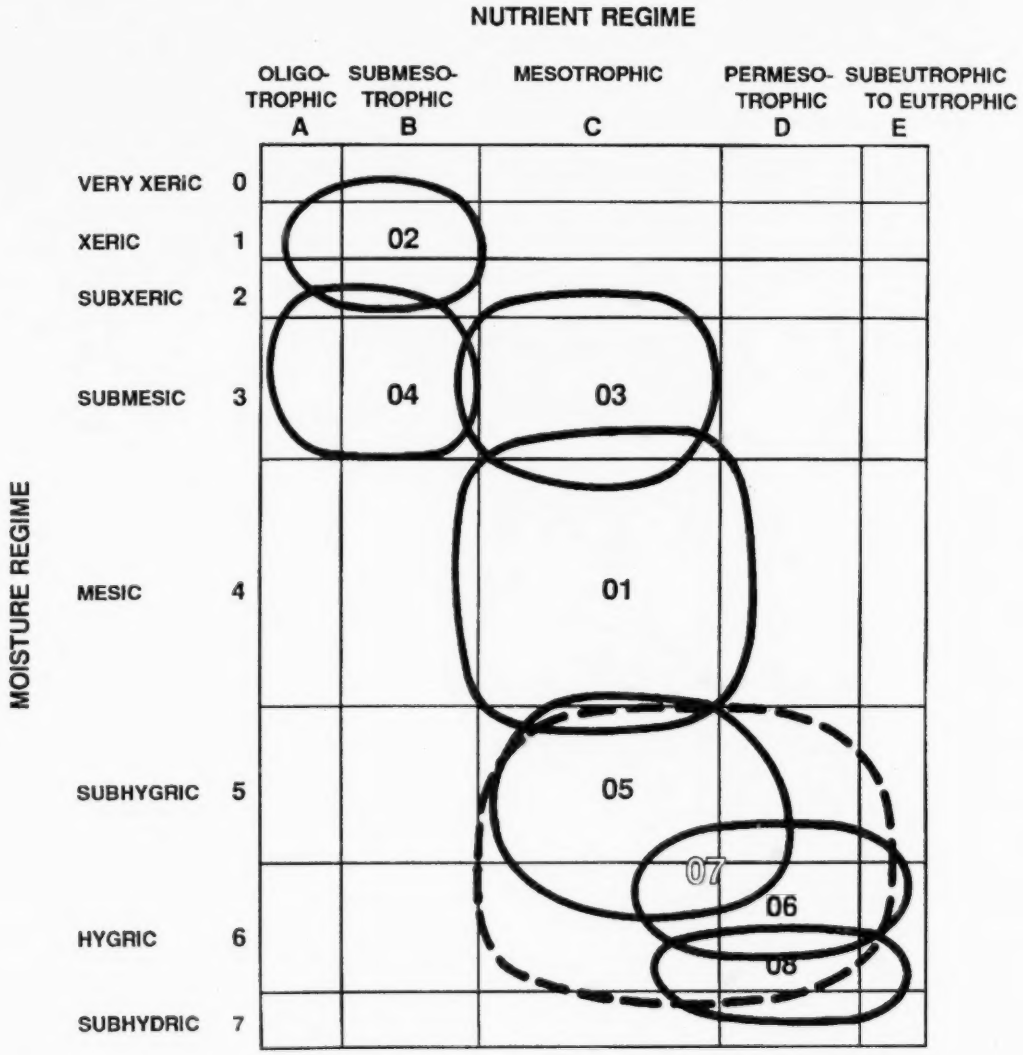


FIGURE 8. Edatopic grid of the ESSFi.

5.2 Key to Site Units of the ESSFi

A Lower to toe slopes; moderately well to poorly drained sites; seepage and gleying frequent ..... B

AA Upper to lower slopes; rapidly to moderately well drained sites; seepage and gleying infrequent or lacking ..... E

B Imperfectly to poorly drained sites C

C Toe slopes; poorly drained sites; water table at or near the surface; *Equisetum* spp. dominate herb layer

HORSETAIL (ESSFi/08)

CC Lower to toe slopes; imperfectly to poorly drained sites; water table usually not near the surface; *Equisetum* spp. infrequent or lacking in herb layer; open-grown stands adjoining parkland

MEADOW FOREST (ESSFi/07)

BB Moderately well to imperfectly drained sites ..... D

D Moderately well to imperfectly drained sites; seepage and/or gleying may or may not be present; *Oplopanax horridus* uncommon in shrub layers; *Gymnocarpium dryopteris* dominates herb layer

OAK FERN (ESSFi/05)

DD Imperfectly drained sites; seepage and/or gleying usually present; *Oplopanax horridus* prominent in shrub layers; herb layer with several ferns (*G. dryopteris, Dryopteris assimilis, Athyrium filix-femina*) but not dominated solely by *Gymnocarpium*

DEVIL'S CLUB (ESSFi/06)

E Upper to lower (typically middle) slopes; moderately well drained sites

HUCKLEBERRY — BUNCHBERRY — MOSS (ESSFi/01)

EE Upper slopes to crests; rapidly to well drained sites ..... F

F Crests; shallow soils usually on bedrock knobs; lichens frequent in moss layer; driest sites in subzone

LICHEN — MOSS (ESSFi/02)

FF Upper slopes to crests; moss layer a carpet of feathermosses with few or no lichens ..... G

G Subalpine fir dominates tree canopy and advance regeneration

SUBALPINE FIR — MOSS (ESSFi/03)

GG Mountain hemlock dominates tree canopy; abundant advance regeneration of mountain and western hemlock

MOUNTAIN HEMLOCK — MOSS (ESSFi/04)

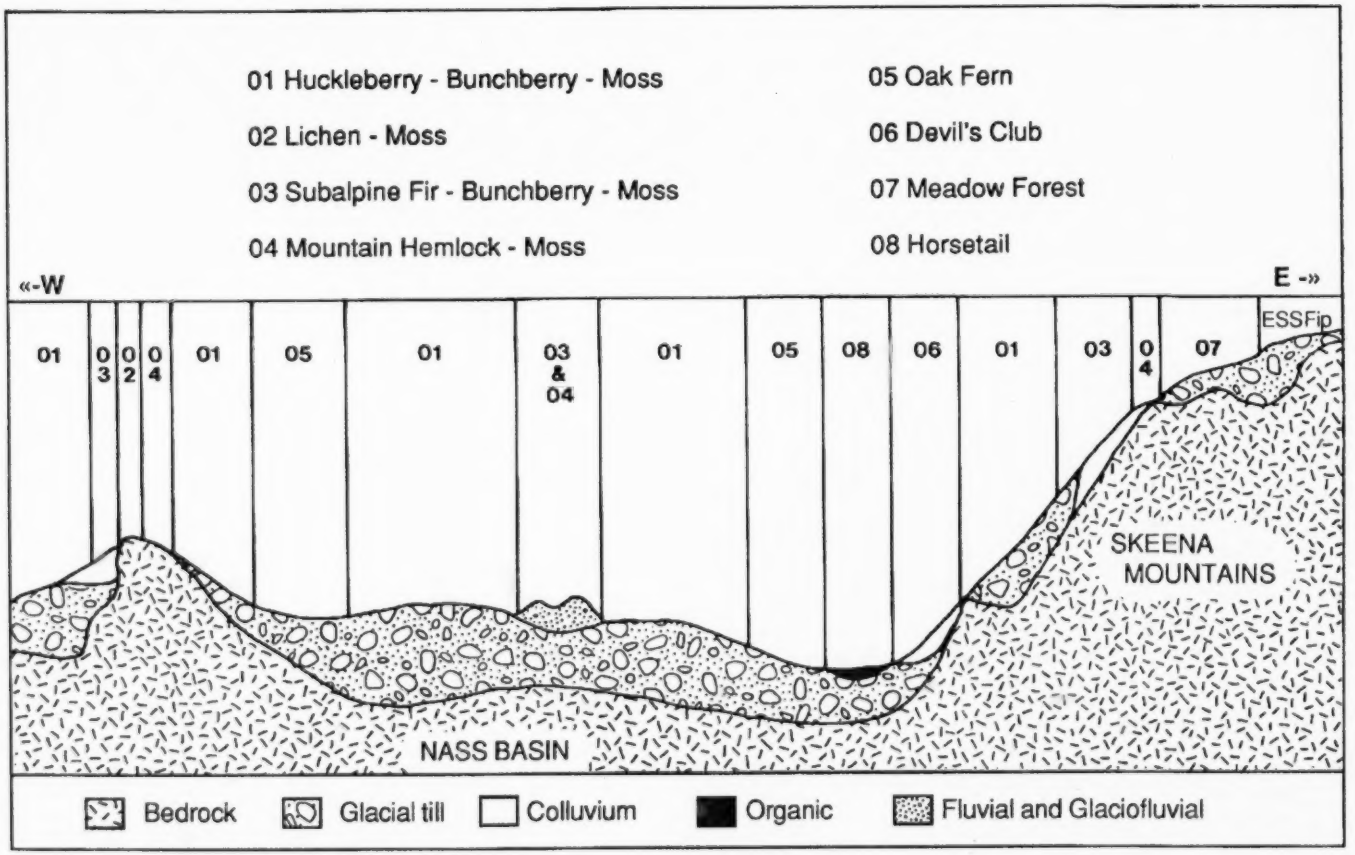


FIGURE 9. Schematic sequence of ecosystems in the ESSFi landscape in the Nass Basin.

5.3 Description and Interpretation of Site Units of the ESSFi

Selected habitat features associated with the site units are presented in Table 5 (page 46). Table 6 (page 48) summarizes silvicultural interpretations for the ESSFi.

Following these two tables are descriptions and interpretations of the various site units. The small figure in the upper right-hand corner of the descriptive page is an edatopic grid indicating the usual moisture and nutrient regime for the particular site series. In addition, a small textural triangle outlines the range of mineral textures found within the site unit. If two soil texture phases are defined, they are differentiated by black (medium and coarse textures) and white (fine textures) areas.

Species that are consistently present but with low cover; or inconsistently present but with high cover, are enclosed within parentheses. Under the vegetation column, the figures that appear in brackets (e.g., [57]) indicate the average cover of the tree, shrub, herb, or moss layers as extracted from vegetation tables. Layer development may be indicated as sparse (less than 5% total cover), poorly developed (5–15%), moderately developed (15–35%), well developed (35–60%), or very well developed (60%+).

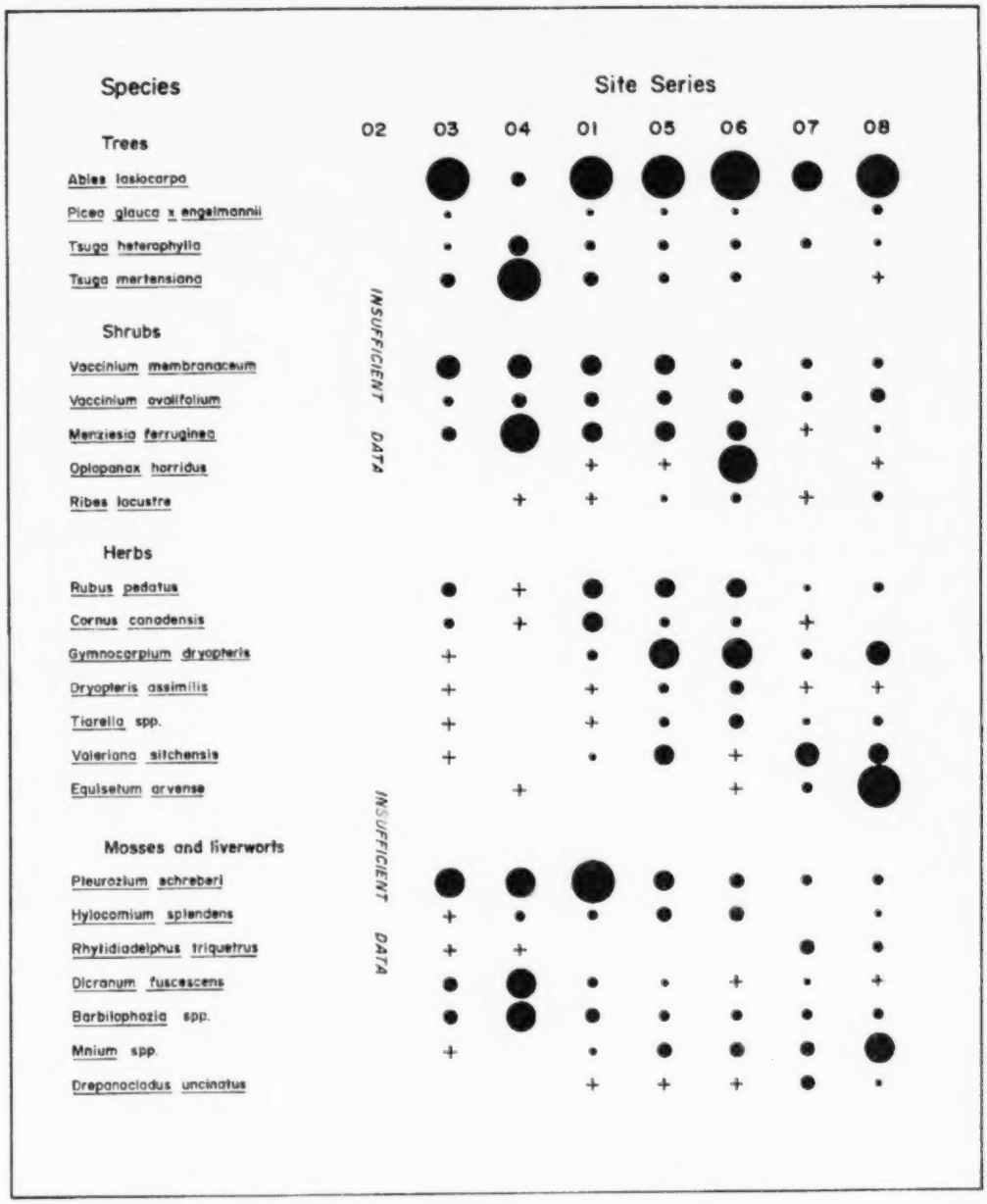


FIGURE 10. Prominence values for major species of the ESSFi.

TABLE 5. Environmental features of site units in the ESSFi

Site unit	Moisture/ nutrient regimes	Slope gradient	Parent materials[a] (%)	Texture[b] class	Drainage class
/02 Lichen — Moss	0–2/A-B	0–25	Mv/R, Cv/R	S	rapidly
/03 Bl — Moss	3/C	15–70	Mv/R, Cv/R	SL, LS, L	well-rapidly
/04 Hm — Moss	2–3/A-B	0–40	Mv/R, Ov/R	SL	well-rapidly
/01 Huckleberry — Bunchberry — Moss	4/C	5–60	Mv, Cv, Cb, Mb	L, SL, LS	moderately well
/05 Oak Fern	5/C-D	20–45	Mb, Cb (washed)	SL, SiL, CL, L	mod. well-imperfectly
/06 Devil's Club	5–6/C-E	25–70	Fv/Cb, Mb, Cb	SL, L	imperfectly
/07 Meadow Forest	5–6/C-E	0–40	Fv/Mb, Mb	SL, L, SiL	imperfectly-poorly
/08 Horsetail	6–7/C-E	5–15	Fv, Fb, Ov/Fb	SL, L, SiL	poorly

[a] Parent material abbreviations: M — morainal; C — colluvium; FG — glaciofluvial; O — organic; F — fluvial; R — bedrock; v — veneer; b — blanket; f — fan.

[b] Texture abbreviations: S — sand; LS — loamy sand; SL — sandy loam; L — loam; CL — clay loam; SiL — silt loam.

TABLE 5. — *Continued*

Site unit	Soil[c]	Humus form[d] and depth (cm)	Rooting depth[e] (cm)	Slope positions
/02 Lichen — Moss	O.HFP	XR, HR	30+	crest
/03 Bl — Moss	O.HFP, PZ.GL	HR 4–12	20–40	upper
/04 Hm — Moss	O.HFP, TY.FO	HUR 5–40	3–25	upper-crest
/01 Huckleberry — Bunchberry — Moss	O.FHP, O.HFP	HHR 5–15	20–70	lower to upper
/05 Oak Fern	GL.GL, GL.FHP	HHR, HUR 7–20	25–55	lower to toe
/06 Devil's Club	O.FHP, GL.FHP,O.HG	MMD, HHR 7–30	10–90	lower to toe
/07 Meadow Forest	O.G, GL.HFP, GL.FHP,	HHR, HUR, HMD 4–18	0–40	lower to toe
/08 Horsetail	O.G	HYR 12–17	0–28	toe

[c] Abbreviations of soil classification: O.HFP — Orthic Humo-Ferric Podzols; O.FHP — Orthic Ferro-Humic Podzols; GL.HFP — Gleyed Humo Ferric Podzols; GL.FHP — Gleyed Ferro-Humic Podzols; PZ.GL — Podzolic Gray Luvisols; GL.GL — Gleyed Gray Luvisols; O.HG — Orthic Humic Gleysols; O.G — Orthic Gleysols; TY.FO — Typic Folisols.

[d] Abbreviations of humus form classification: HR — Hemimors; HHR — Hemihumimors; HUR — Humimors; XR — Xeromors; MMD — Mormoders; HYR — Hydromors; HMD — Histomoders; HYS — Hydrosaprimulls.

[e] Rooting depth measured from organic/mineral interface.

TABLE 6. Summary of silvicultural prescriptions and guidelines for the ESSFi

Site unit	Season of logging	Site preparation		Species choice[a]		Brush potential
		Mech.	Burning	Pref.	Accept.	
/02	A V O I D L O G G I N G				Pl[b]	very low
/03	summer	OK	AVOID	Pl[b]	Bl[c] Sxw[c,d]	very low
/04	A V O I D L O G G I N G				Pl[b], Hm	very low
/01	summer to winter	OK	OK[e]	Sx[d], Pl[b,f]	Bl	low
/05	winter or late summer	OK[g]	OK	Sx[d]	Bl	moderate to high
/06	winter	OK[g]	OK	Sx[d]	Bl	very high
/07	winter[h]	AVOID	AVOID	Sx[d]	Bl	low
/08	winter	AVOID	OK	Sx[d]	Bl	very high

[a] A preferred species for a managed forest is ecologically appropriate to the site and best suited to management objectives. An acceptable species is ecologically appropriate but less suited to management objectives.

[b] Conditional upon how well Pl eventually performs and withstands damage from the heavy, moist snow of this subzone.

[c] Acceptable only if it comprises a minority of the stand.

[d] Sxw not preferred (but still acceptable) in stands with incidence of tomentose root rot and unacceptable within infection centres. Replace with other preferred/acceptable species as required.

[e] Burning should be avoided on coarse-textured soils or strong southern aspects of the Mesic site series.

[f] Pl preferred on coarse-textured soils or southern aspects, otherwise merely acceptable.

[g] Mechanical site preparation should proceed during the driest portions of the year or after soils have frozen to minimize establishment of brush species.

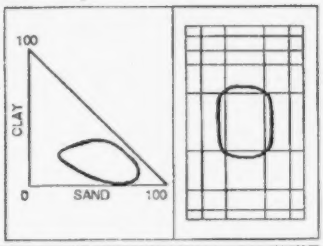
[h] The open growing Meadow Forest site series should be selectively logged or removed from development plans owing to very limited growth and survival of natural regeneration following clearcut logging.

HUCKLEBERRY — BUNCHBERRY — MOSS (ESSFi/01)

SLOPE POSITIONS: (Lower), middle, and (upper) slopes

SLOPE GRADIENT: 5–60%

ASPECT: Predominantly north and east



VEGETATION LAYERS

TREE [54]: Generally more open canopy than in ICHmc/01.
- Bl
- (Hm)
- (Hw)
- (Sxx)

SHRUB [61]: Well developed with abundant advance regen. of Bl, Hm, and Hw.
- *Vaccinium membranaceum*
- *Menziesia ferruginea*
- *Vaccinium ovalifolium*
- (*Sorbus sitchensis*)
- (*Sorbus scopulina*)

HERB [41]: Moderately to well developed.
- *Cornus canadensis*
- *Rubus pedatus*
- *Orthilia secunda*
- (*Gymnocarpium dryopteris*)
- (*Streptopus amplexifolius*)
- (*Streptopus roseus*)
- (*Tiarella* spp.)

MOSS [80]: Very well-developed carpet of feathermosses.
- *Pleurozium schreberi*
- *Barbilophozia lycopodioides*
- *Ptilium crista-castrensis*
- *Peltigera* spp.
- (*Hylocomium splendens*)
- (*Dicranum* spp.)

SOILS

LANDFORM:
Morainal veneers and blankets; colluvial veneers, blankets, and aprons.

TEXTURE:
Loam, sandy loam.

DRAINAGE:
Moderately good to good.

EFFECTIVE ROOTING:
20–70 cm.

SOIL NAME:
Orthic Ferro-Humic and Humo-Ferric Podzols.

HUMUS FORM AND DEPTH:
Hemihumimors; (Humimors, Hemimors). 5–15 cm.

OTHER FEATURES:
Bedrock common at 50+ cm, particularly on upper slopes.
Podzolic B horizons darker coloured than in ESSFk or ESSFl.
Humus forms have noticeable H horizons.

COMMENTS: Widespread on modal sites throughout the ESSFi.

HUCKLEBERRY — BUNCHBERRY — MOSS (ESSFi/01)

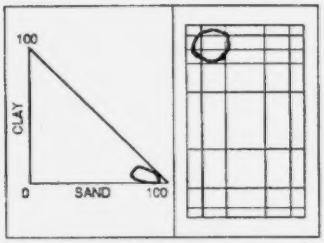
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Pl on coarse-textured soils (dominant). — Sxw on finer textured soils.
Acceptable	— Bl.
Logging:	— season not critical. — in moist, fine-textured soils delay until winter freeze-up. — check for hardpan layers and potential for windfall; adjust block layout if necessary.
Site preparation:	
Mechanical	— OK. — in finer textured soils, avoid planting in depressions or gouges following scraping.
Prescribed fire	— OK. — USE CAUTION on coarse soils or sites with steep (greater than 35%) southerly aspects. — aim for a light burn to consume fine and medium fuels and approx. 30–40% of the F horizon.
Brush hazard:	— generally low. — *Vaccinium* spp. may restrict planter access and seedling establishment.
Reforestation:	— plant Pl or Sxw. — use plugs on coarse, rocky soils. — deeper humus forms may necessitate screefing.

LICHEN — MOSS (ESSFi/02)

SLOPE POSITIONS: Crest

SLOPE GRADIENT: 0–25% on convex surfaces

ASPECT: South and crests



VEGETATION LAYERS	SOILS
TREE [43]: Open and scrubby. Bl (Hm) (Hw) (Pl)	LANDFORM: Discontinuous morainal and colluvial veneers over bedrock.
SHRUB [90]: Very well developed with abundant advance regen. of Bl and the two hemlock species. *Menziesia ferruginea* *Vaccinium membranaceum* (*Vaccinium ovalifolium*) (*Sorbus sitchensis*) (*Sorbus scopulina*)	TEXTURE: Sandy with high coarse fragment content (75+%).
HERB [21]: Poorly to moderately developed; low diversity. *Cornus canadensis* *Rubus pedatus* *Orthilia secunda*	DRAINAGE: Rapid.
MOSS [95]: Very well developed. *Pleurozium schreberi* *Dicranum fuscescens* *Barbilophozia* spp. *Cladonia* spp. *Cladina* spp.	EFFECTIVE ROOTING: 30+ cm.
	SOIL NAME: Orthic Humo-Ferric Podzols (shallow lithic phase).
	HUMUS FORM: Hemimors; Xeromors.
	OTHER FEATURES: Occurs on the subzone's driest sites with shallow rocky soils; usually associated with bedrock knobs.

COMMENTS: Uncommon and local site series in the ESSFi.

LICHEN — MOSS (ESSFi/02)

ACTIVITY OR CONCERN

AVOID LOGGING

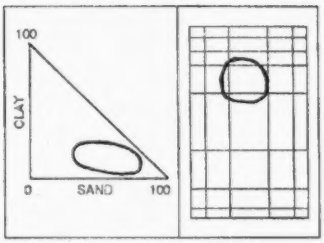
These ecosystems are marginal for timber production. If they are included within larger openings, then consider their harvesting as timber mining. Plant Pl plugs if necessary.

SUBALPINE FIR — MOSS (ESSFi/03)

SLOPE POSITIONS: Upper

SLOPE GRADIENT: 15–70%

ASPECT: South and west



VEGETATION LAYERS	SOILS
TREES [68]: Scrubby; irregular canopy. Bl (Hm) (Sxx) (Hw)	LANDFORM: Morainal and colluvial veneers over bedrock.
SHRUB [42]: Variable; abundant advance regeneration of Bl, Hw, Hm, Sxx. *Menziesia ferruginea* *Vaccinium membranaceum* *Vaccinium ovalifolium* *Sorbus sitchensis* *Sorbus scopulina*	TEXTURE: Sandy loam, loamy sand, loam.
HERB [23]: Poorly to moderately developed; low diversity. *Cornus candensis* *Rubus pedatus* *Orthilia secunda*	DRAINAGE: Good to rapid.
MOSS [86]: Very well-developed carpet, dominated by feathermoss. *Pleurozium schreberi* *Dicranum fuscescens* *Barbilophozia* spp.	EFFECTIVE ROOTING: 20–40 cm.
	SOIL NAME: Orthic Humo-Ferric Podzols, Podzolic Gray Luvisols.
	HUMUS FORM AND DEPTH: Hemimors. 4–12 cm.
	OTHER FEATURES: Very acidic mineral soil (pH 3.9) and humus (pH 3.4); abundant decaying wood on soil surface; Podzolic Bf horizon (bright red colour); shallower soil than mesic site series.

COMMENTS: Common site series on the upper portions of long slopes. Similar in some respects to the mesic site series, but herb layer less developed and soils have brighter colours and lower content of organic matter.

SUBALPINE FIR — MOSS (ESSFi/03)

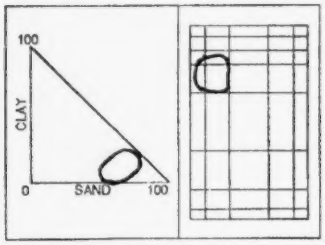
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Pl.
Acceptable	— Bl, Sxw (minor components of stand).
Logging:	— summer log. — potential windfall hazard due to shallow soils; adjust block layout where necessary.
Site preparation:	
Mechanical	— OK; preferable to burning. — maintain humus on site.
Prescribed fire	— DO NOT BURN. — loss of organic matter will reduce site productivity.
Brush hazard:	— very low.
Reforestation:	— plant Pl if required. — use plugs on rocky soils.

MOUNTAIN HEMLOCK — MOSS (ESSFi/04)

SLOPE POSITIONS: Upper slope and crest

SLOPE GRADIENT: 0–40%

ASPECT: South and ridge crests



VEGETATION LAYERS	SOILS
TREES [60]: Scrubby; mountain hemlock dominates main canopy. Hm (Hw) (Bl)	LANDFORM: Morainal and organic veneer overlying bedrock.
SHRUB [70]: Very well developed; abundant Hm and Hw advance regeneration. *Menziesia ferruginea* *Vaccinium membranaceum* *Vaccinium ovalifolium*	TEXTURE: Sandy loam.
HERB [1]: Sparse or absent. (*Cornus canadensis*) (*Rubus pedatus*)	DRAINAGE: Good to rapid.
MOSS [90]: Thick carpet of mosses. *Pleurozium schreberi* *Dicranum fuscescens* *Barbilophozia floerkei* *Cladonia* spp. *Nephroma arcticum*	EFFECTIVE ROOTING: 3–25 cm. SOIL NAME: Orthic Humo-Ferric Podzols; Typic Folisols. HUMUS FORM AND DEPTH: Humimors; 5–40 cm.

COMMENTS: Common on moisture-shedding crests of ridges, knolls, and hills. Very acidic, nutrient-poor mineral soils with low levels of organic matter and nitrogen. Slowly decomposing humus forms are dominated by H horizons. Similar site series to ESSFi/03 except for dominance of mountain hemlock in main and lower canopy and very sparse herb layer.

MOUNTAIN HEMLOCK — MOSS (ESSFi/04)

ACTIVITY OR CONCERN

AVOID LOGGING

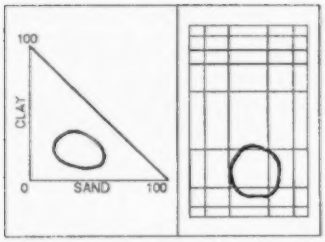
These ecosystems are marginal for timber production. If they are included within larger openings, then consider their harvesting as timber mining. Very shallow soils and rock outcrops dominate, rendering these sites very sensitive to disturbance from logging and subsequent site preparation. In deeper soils, planting Pl may produce a viable crop.

OAK FERN (ESSFi/05)

SLOPE POSITIONS: Lower to toe

SLOPE GRADIENT: 20–45%

ASPECT: Primarily north and west



VEGETATION LAYERS

TREE [37]: Open canopy of large trees.
- Bl
- (Sxx)
- (Hw)
- (Hm)

SHRUB [59]: Well developed; abundant advance regen. of Bl.
- *Menziesia ferruginea*
- *Vaccinium ovalifolium*
- *Vaccinium membranaceum*
- *Ribes lacustre*
- *(Oplopanax horridus)*
- *(Sorbus sitchensis)*

HERB [73]: Very well developed and diverse.
- *Gymnocarpium dryopteris*
- *Tiarella* spp.
- *Streptopus amplexifolius*
- *Streptopus roseus*
- *Valeriana sitchensis*
- *Listera cordata*
- *Veratrum viride*
- *Rubus pedatus*
- *Cornus canadensis*
- *Lycopodium annotinum*

MOSS [67]: Fewer feather-mosses and more leafy mosses relative to mesic and drier sites.
- *Mnium* spp.
- *Brachythecium* spp.
- *Pleurozium schreberi*
- *Ptilium crista-castrensis*

SOILS

LANDFORM:
Morainal and colluvial blankets, occasionally washed near surface.

TEXTURE:
Loamy (fine to coarse).

DRAINAGE:
Moderately good to imperfect.

EFFECTIVE ROOTING:
25–55 cm.

SOIL NAME:
Gleyed Ferro-Humic Podzols; Gleyed Gray Luvisols.

HUMUS FORM AND DEPTH:
Hemihumimors; Humimors. 7–20 cm.

OTHER FEATURES:
Moist soils with periodic seepage at depth; soil colours are darker and duller than those of mesic sites.

COMMENTS: Quite extensive in the southern two-thirds of the ESSFi. Next to the mesic series this is the most common site series of the ESSFi. Soils are very moist and fertile.

OAK FERN (ESSFi/05)

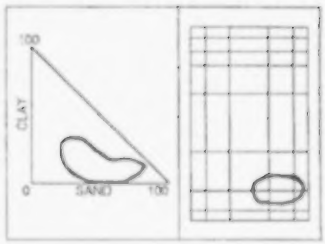
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sx.
Acceptable	— Bl.
Logging:	— winter or late summer (if dry). — excessive soil disturbance may increase brush hazard.
Site preparation:	
Mechanical	— OK. — conduct during dry periods only.
Prescribed fire	— OK. — only low to medium intensity burns on sites not having dark-coloured surface mineral horizons (Ah, Bhf). — hotter burns possible on fine-textured soils having considerable organic matter incorporation in mineral horizons.
Brush hazard:	— moderate to high. — plan for one maintenance treatment; assess at time of planting or preharvest silviculture assessment.
Reforestation:	— PLANT ASAP WITH Sx. — plant vigorous stock on elevated mounds where possible.

DEVIL'S CLUB (ESSFi/06)

SLOPE POSITIONS: Lower and toe

SLOPE GRADIENT: 25–70%

ASPECT: Variable



VEGETATION LAYERS

TREE [70]: Large decadent trees; productive sites.
Bl
(Sxx)

SHRUB [75]: Very well developed, often with dense Bl regen.
Oplopanax horridus
Menziesia ferruginea
Vaccinium membranaceum
(*Vaccinium ovalifolium*)
(*Ribes lacustre*)
(*Alnus viridis*)

HERB [65]: Very well developed and diverse.
Gymnocarpium dryopteris
Tiarella spp.
Streptopus amplexifolius
Athyrium filix-femina
Dryopteris assimilis
Veratrum viride
Rubus pedatus
Cornus canadensis
Lycopodium annotinum

MOSS [63]: Well developed but patchy; leafy mosses common.
Mnium spp.
Brachythecium spp.
Rhytidiadelphus loreus
(*Pleurozium schreberi*)
(*Ptilium crista-castrensis*)
(*Hylocomium splendens*)

SOILS

LANDFORM:
Morainal and colluvial veneers and blankets, often showing signs of having been water-worked.

TEXTURE:
Sandy loam, loam.

DRAINAGE:
Imperfect.

EFFECTIVE ROOTING:
Variable; 10–90 cm.

SOIL NAME:
Orthic, Duric, and Gleyed Ferro-Humic Podzols; Orthic Humic Gleysols.

HUMUS FORM AND DEPTH:
Mormoders; Hemihumimors. 7–30 cm.

OTHER FEATURES:
Abundant seepage in lower B horizons; loose, permeable soil in upper horizons; dark-coloured surface horizons; mottling common; loose humus forms.

COMMENTS: Restricted distribution, mainly confined to steep sideslopes at lower elevations of the subzone. Very fertile sites.

DEVIL'S CLUB (ESSFi/06)

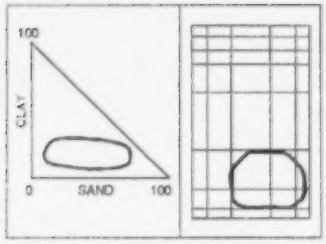
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sx.
Acceptable	— Bl.
Logging:	— winter or after ground has frozen. — excessive soil disturbance will likely increase brush hazard.
Site preparation:	
Mechanical	— OK. — conduct during dry periods only. — avoid on steep, unstable slopes.
Prescribed fire	— OK. — will TEMPORARILY (maybe for 1–3 years) reduce brush problem.
Brush hazard:	— High to very high. — plan for at least one maintenance treatment; assess at time of planting or preharvest silviculture assessment.
Reforestation:	— PLANT Sx IMMEDIATELY. — plant vigorous stock on elevated mounds where possible, to keep roots above water table.

MEADOW FOREST (ESSFi/07)

SLOPE POSITIONS: **Lower to toe slopes at high elevations**

SLOPE GRADIENT: **10–30%**

ASPECT: **All**



VEGETATION LAYERS

TREES [31]: Open patchy canopy; trees have clumped distribution.
- Bl
- (Sxx)
- (Hm)
- (Hw)

SHRUBS [35]: Moderately developed with most shrubs around tree clumps.
- *Ribes glandulosum*
- *Vaccinium membranaceum*
- *Vaccinium ovalifolium*
- *Menziesia ferruginea*

HERB [70]: Dense, very well developed and diverse, particularly in openings.
- *Valeriana sitchensis*
- *Veratrum viride*
- *Senecio triangularis*
- *Parnassia fimbriata*
- *Arnica cordifolia*
- *Tiarella* spp.
- *Streptopus* spp.
- *Gymnocarpium dryopteris*
- *Osmorhiza purpurea*
- *Epilobium anagallidifolium*
- (*Heracleum sphondylium*)

MOSS [75]: Very well developed.
- *Mnium* spp.
- *Rhytidiadelphus squarrosus*
- *Drepanocladus uncinatus*
- *Brachythecium* spp.
- *Barbilophozia* spp.

SOILS

LANDFORM:
Morainal blankets often with a fluvial veneer.

TEXTURE:
Sandy loam, loam, silt loam.

DRAINAGE:
Imperfect to poor.

EFFECTIVE ROOTING:
Largely in humus to as deep as 50 cm in mineral soil.

SOIL NAME:
Orthic Gleysols, Gleyed Humo-Ferric Podzols, Gleyed Ferro-Humic Podzols.

HUMUS FORM AND DEPTH:
Hemihumimors; Humimors; Mormoders; Histomoders; 4–20 cm.

OTHER FEATURES:
Abundant seepage; rich soils with abundant organic matter incorporation; few coarse fragments; low soil temperatures.

COMMENTS: This site series occurs as a mosaic of groups of trees on elevated microsites and herb-rich meadows in slight depressional areas. Although soils are fertile, productivity is limited by adverse local climate and short growing season.

MEADOW FOREST (ESSFi/07)

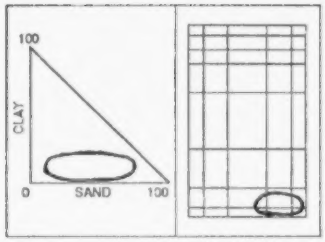
ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sx.
Acceptable	— Bl.
Logging:	— winter logging preferred to minimize soil compaction and improve trafficability. — preserve and promote natural regeneration by selective logging.
Site preparation:	
Mechanical	— AVOID.
Prescribed fire	— AVOID.
Brush hazard:	— low.
Reforestation:	— plant Sx if extensive areas of this unit are logged. — severe planting check expected in ecosystems exposed to severe climatic conditions. — promote natural regeneration where possible.

HORSETAIL (ESSFi/08)

SLOPE POSITIONS: Toe slope

SLOPE GRADIENT: 5–15%

ASPECT: All



VEGETATION LAYERS

TREE [41]: Open stands; trees growing on hummocks.
Bl
(Sxx)

SHRUB [47]: Well developed with frequent Bl advance regen.; minor Hm, Hw regen. on hummocks.
Ribes lacustre
Vaccinium membranaceum
Vaccinium ovalifolium
(*Lonicera involucrata*)
(*Oplopanax horridus*)
(*Menziesia ferruginea*)

HERB [90]: Very well developed and diverse; dominated by horsetails.
Equisetum arvense
Valeriana sitchensis
Veratrum viride
Senecio triangularis
Tiarella spp.
Gymnocarpium dryopteris
Calamagrostis canadensis
Mitella pentandra
(*Athyrium filix-femina*)
(*Viola glabella*)

MOSS [75]: Dominated by leafy mosses.
Mnium spp.
Rhytidiadelphus squarrosus
Barbilophozia lycopodioides
Pleurozium schreberi (raised microsites)

SOILS

LANDFORM:
Fluvial veneers, blankets, and aprons.

TEXTURE:
Sandy loam, loam, silt loam.

DRAINAGE:
Poor.

EFFECTIVE ROOTING:
Largely in humus to as deep as 30 cm in mineral soil.

SOIL NAME:
Orthic Gleysols.

HUMUS FORM AND DEPTH:
Hydromoders in depressions; Hemimors on raised hummocks. 12–17 cm.

OTHER FEATURES:
Seepage and/or water table close to surface; mottled soils characteristic; mucky surface organics.

COMMENTS: Common but not extensive on toe slope and slightly depressed areas. Poor drainage restricts productivity on these otherwise rich sites.

HORSETAIL (ESSFi/08)

ACTIVITY OR CONCERN	
Species choice:	
Preferred	— Sx.
Acceptable	— Bl.
Logging:	— winter or when ground is frozen. — excessive soil disturbance may increase brush hazard.
Site preparation:	
Mechanical	— mounding. — preserve natural mounds where possible.
Prescribed fire	— OK, but difficult. — beneficial for species conversion but these wet sites do not carry fire well.
Brush hazard:	— High to very high. — plan for at least one maintenance treatment; assess at the time of planting or preharvest silviculture assessment.
Reforestation:	— PLANT Sx IMMEDIATELY ON ELEVATED MOUNDS. — plant vigorous stock. — beware frost heaving in soils high in silt. — when planting on mounds the minimum stocking standards may be reduced by increased number of unplantable spots.

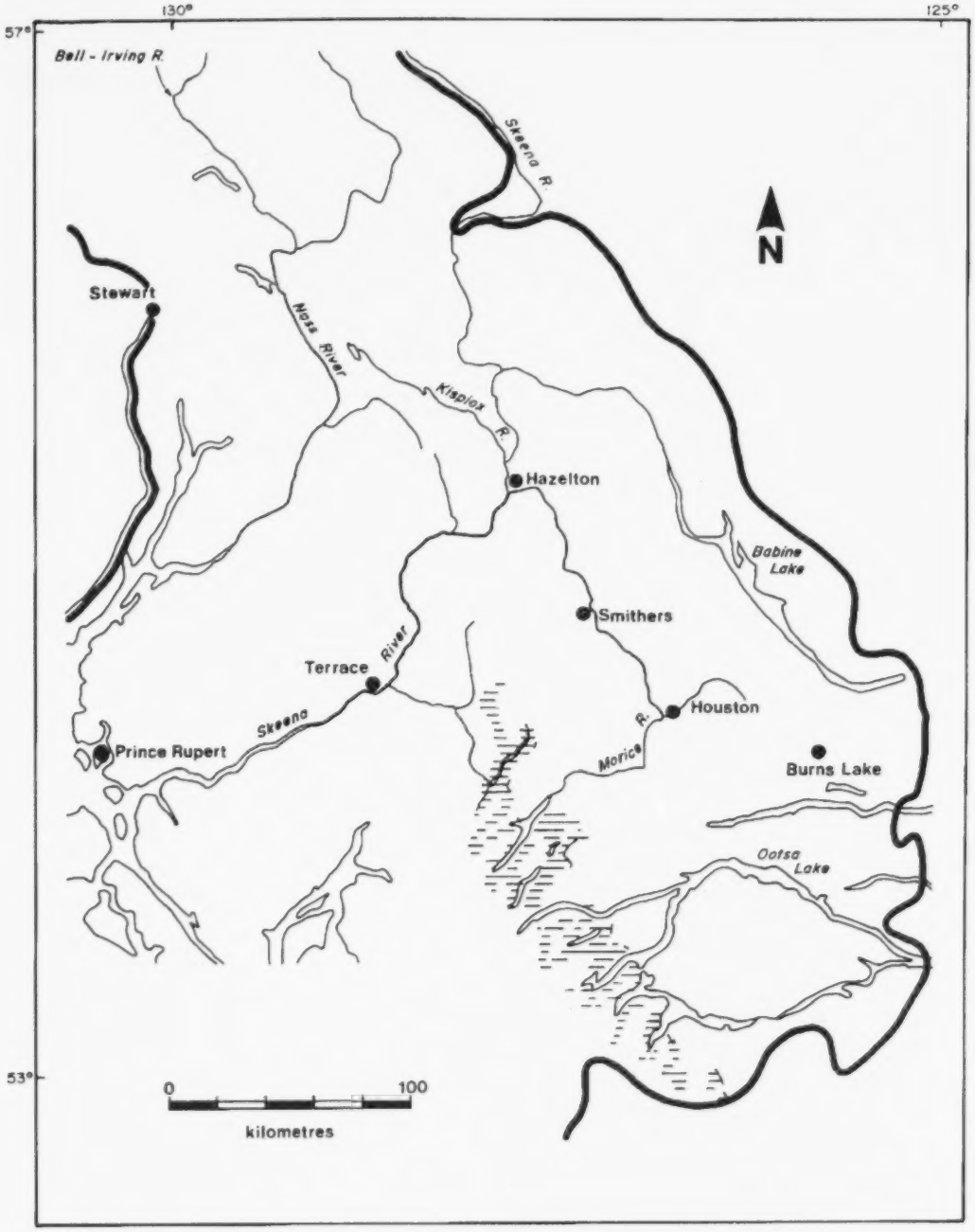


FIGURE 11. The Subcontinental Central Engelmann Spruce — Subalpine Fir Subzone (ESSFI) in the Prince Rupert Forest Region.

6.1 Site Units of the ESSFI — Subcontinental Central Subzone

/01 Huckleberry — Queen's Cup — Moss site series
/02 Whitebark Pine — Lichen site series
  /02(a) Lithic phase
  /02(b) Fluvial phase
/03 Lichen — Moss site series
/04 Oak Fern site series
/05 Devil's Club site series
/06 Horsetail site series

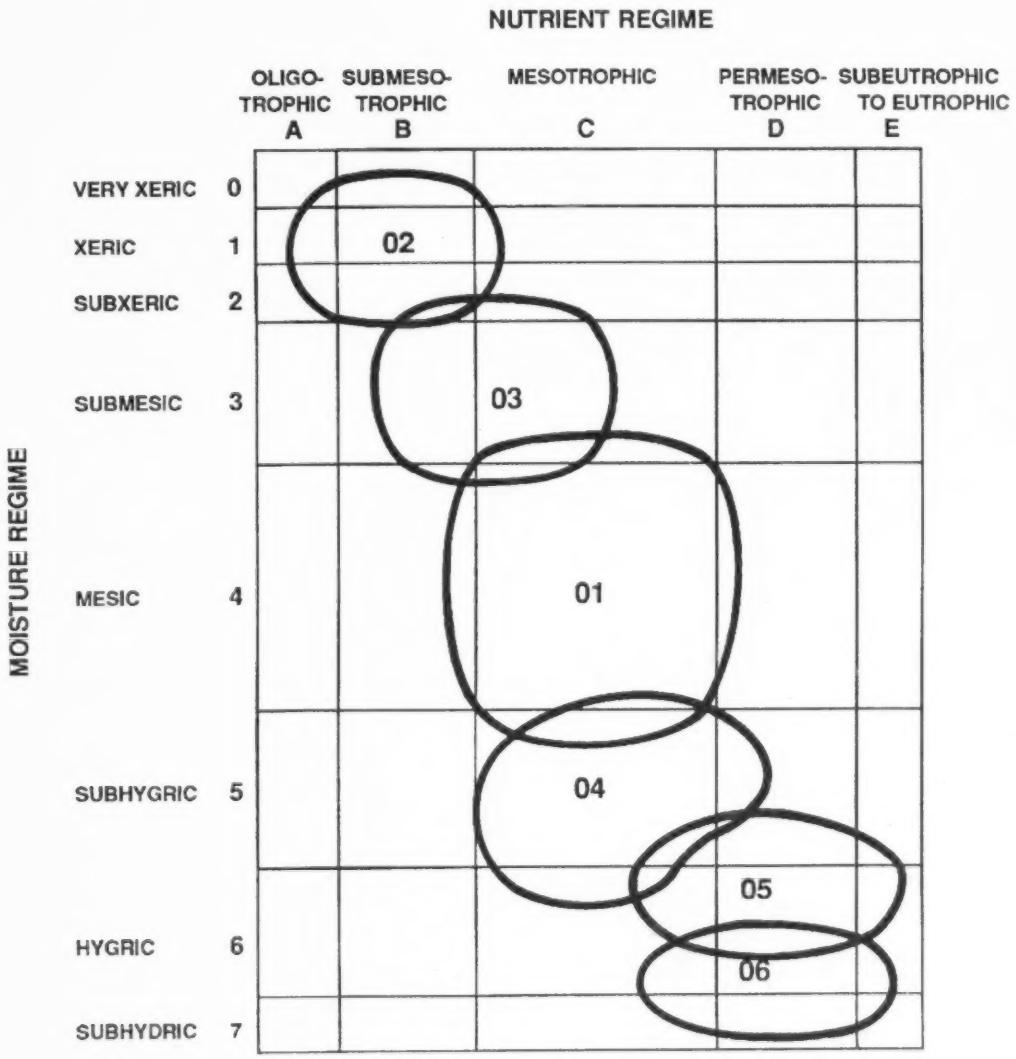


FIGURE 12. Edatopic grid of the ESSFI.

6.2 Key to Site Units of the ESSFI

A Poorly drained sites with water table present at or near the surface; *Equisetum* spp. dominate herb layer

HORSETAIL (ESSFI/06)

AA Water table absent, or sometimes present at depth; *Equisetum* spp. absent, or present but with less than 5% cover ..... B

B Upper slopes, or middle to lower slopes on coarse-textured, well to rapidly drained parent materials; ferns and *Mnium* spp. sparse or absent C

C Rapidly drained, often gravelly parent materials; whitebark pine common in tree canopy; lichens dominate moss layer; driest sites in the subzone

WHITEBARK PINE — LICHEN (ESSFI/02)

(i) Middle, upper, crest slope positions; colluvial and morainal veneers overlying bedrock

Lithic phase [ESSFI/02(a)]

(ii) Middle, lower, level slope positions; very coarse fluvial and glaciofluvial blankets

Fluvial phase [ESSFI/02(b)]

CC Well drained but usually not gravelly parent materials; whitebark pine uncommon in tree canopy; lichens common in moss layer, but co-dominant with mosses and liverworts

LICHEN — MOSS (ESSFI/03)

BB Middle to toe slopes on moderately well to imperfectly drained parent materials; ferns and *Mnium* spp. often present ..... D

D Middle to lower slopes on moderately well drained parent materials; seepage usually absent; ferns and *Mnium* spp. infrequent

HUCKLEBERRY — QUEEN'S CUP — MOSS (ESSFI/01)

DD Lower to toe slopes on moderately well to imperfectly drained parent materials; seepage often present in lower B horizons; ferns and *Mnium* spp. frequent and often abundant (greater than 5% cover each) ..... E

E Moderately well drained, moist soils with or without mottling; *Oplopanax horridus* rare or absent in shrub layers; *Gymnocarpium dryopteris* dominates herb layer

OAK FERN (ESSFI/04)

EE Imperfectly drained soils usually with mottling; *Oplopanax* dominates shrub layers; several ferns (*Gymnocarpium, Athyrium, Dryopteris*) common in herb layer

DEVIL'S CLUB (ESSFI/05)

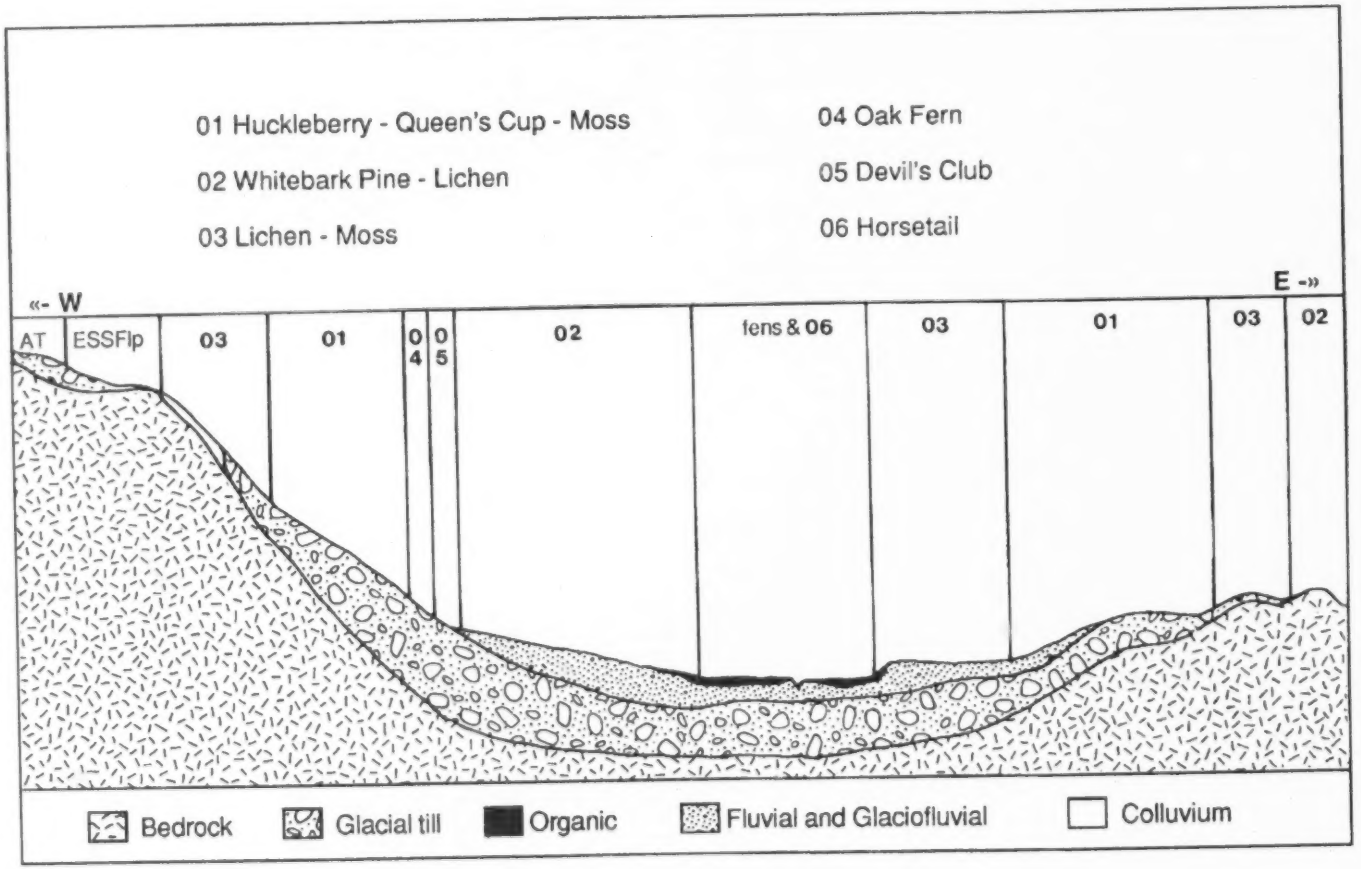


FIGURE 13. Schematic sequence of ecosystems in the ESSFl landscape within the Tahtsa Ranges.

6.3 Description of Site Units of the ESSFI

Selected environmental features associated with the site units are presented in Table 7 (p.71). Table 8 (p.73) summarizes preferred and acceptable species for site units of the ESSFI.

Following these two tables are descriptions of the various site units. Silvicultural prescriptions are not included because there has not been any logging in this subzone. Should interpretations be required, the user should refer to similar ecosystems in the ESSFk Subzone. As with the other subzones, a small edatopic grid and a textural triangle are included in the upper right-hand corner of the descriptive page to provide a quick reference of the usual moisture and nutrient regime and mineral soil texture for a given site series.

Species that are consistently present but with low cover, or present inconsistently with high cover, are enclosed within parentheses. Under the vegetation column, the figures that appear in brackets (e.g., [57]) indicate the average cover of the tree, shrub, herb, or moss layers as extracted from vegetation tables. Layer development may be indicated as sparse (less than 5% total cover), poorly developed (5–15%), moderately developed (15–35%), well developed (35–60%), or very well developed (60%+).

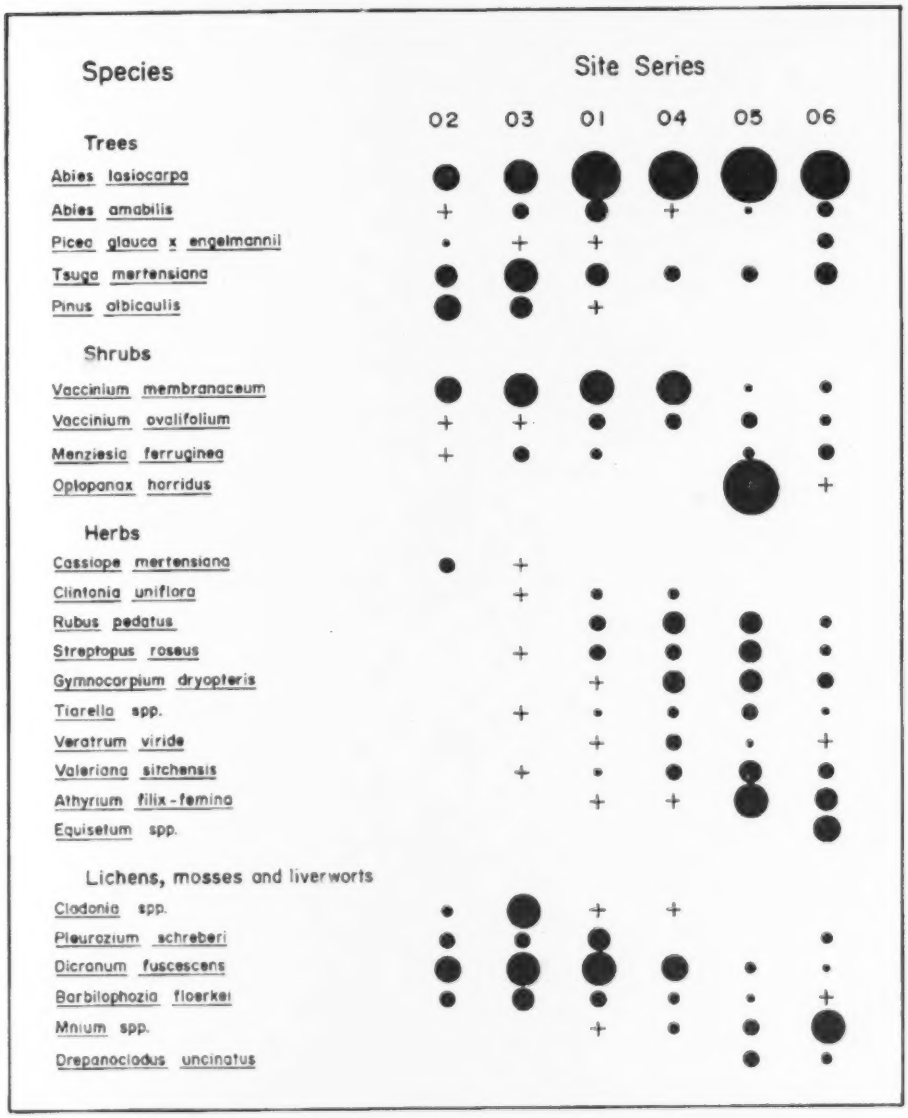


FIGURE 14. Prominence values for major species of the ESSFI.

TABLE 7. Environmental features of site units in the ESSFI

Site unit	Moisture/ nutrient regimes	Slope gradient (%)	Parent materials[a]	Texture[b] class	Drainage class
/02 Whitebark Pine — Lichen	0–2/B				
/02(a) Lithic phase		5–80	Mv/R, Cv/R	S, L (gravelly)	rapidly
/02(b) Fluvial phase		0–15	Fb, FGb	S (gravelly)	rapidly
/03 Lichen — Moss	2–3/B-C	5–35	FGb, Mv, Cv/R, Mb	S, LS, SL L, CL	well
/01 Huckleberry — Queen's cup — Moss	4/C	5–50	Mb, Fb, Fv/M,Cb	SL, L	mod. well to well
/04 Oak Fern	5/C-D	10–25	Mb, Cb	LS, SL, S	mod. well
/05 Devil's Club	5–6/C-E	15–40	washed Cb, Ca, Ff	SL, LS, S	imperfectly
/06 Horsetail	6–7/C-E	0–15	Ov/Fb, Fb	SiL, S, LS	poorly

[a] Parent material abbreviations include: M — morainal; C — colluvium; FG — glaciofluvial; O — organic; F — fluvial; R — bedrock; v — veneer; b — blanket; f — fan; a — apron.

[b] Texture abbreviations include: S — sand; LS — loamy sand; SL — sandy loam; L — loam; CL — clay loam; SiL — silt loam.

TABLE 7. ***Continued***

Site unit	Soil[c]	Humus form[d] and depth (cm)	Rooting depth[e] (cm)	Slope positions
/02 Whitebark Pine — Lichen	O.HFP, E.DYB	XR 1–10	5–75	middle to crest
/03 Lichen — Moss	O.HFP, DU.HFP	HR, XR 2–5	25–50	upper to crest
/01 Huckleberry — Queen's cup — Moss	O.HFP, DU.HFP	HR 2–6	30–60	lower to middle
/04 Oak Fern	O.HFP, GL.HFP	HR, HHR 5–10	30–60	lower to toe
/05 Devil's Club	GL.HFP, GLSM.HFP	MMD, HHR 8–15	30–50	lower to toe
/06 Horsetail	O.G, R.G, GL.HFP	HYR, HR 5–25	0–30	toe and depressions

[c] Abbreviations of soil classification: O.HFP — Orthic Humo-Ferric Podzols; GL.HFP — Gleyed Humo-Ferric Podzols; DU.HFP — Duric Humo-Ferric Podzols; O.G — Orthic Gleysols; R.G — Rego Gleysols; GLSM.HFP — Gleyed Sombric Humo-Ferric Podzols.

[d] Abbreviations of humus form classification: HR — Hemimors; HHR — Hemihumimors; XR — Xeromors; MMD — Mormoders, HYR — Hydromors.

[e] Rooting depth measured from organic/mineral interface.

TABLE 8. Preferred and acceptable species for site units in the ESSFI[a]

Ecosystem unit	Species choice[b] Pref.	Accept.
/02 AVOID LOGGING		Pl[c], Pa
/03	Pl[c]	Pa
/01	Pl[c] Sxw[d]	Bl[e] Ba[e]
/04	Sxw[d]	Pl[c], Bl
/05	Sxw[d]	Bl
/06	Sxw[d]	Bl

[a] Because no logging has occurred in the ESSFI subzone to date, silvicultural guidelines are presently restricted to species selection.

[b] A preferred species for a managed forest is ecologically appropriate to the site and best suited to management objectives. An acceptable species is also ecologically appropriate but less suited to management objectives.

[c] Conditional upon how well Pl eventually performs and withstands damage from the heavy moist snow of this subzone.

[d] Sxw not preferred (but still acceptable) in stands with incidence of tomentose root rot and unacceptable within infection centres. Replace with other preferred/acceptable species as required.

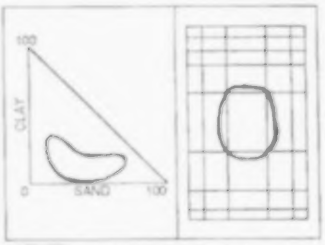
[e] Acceptable species but should comprise a minor component of the stand.

HUCKLEBERRY — QUEEN'S CUP — MOSS (ESSFI/01)

SLOPE POSITIONS: Middle and lower (slope length short) slopes

SLOPE GRADIENT: 5–50%

ASPECT: All



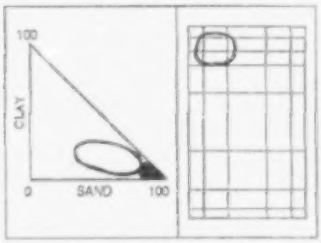
VEGETATION LAYERS	SOILS
TREES [67]: Bl (Hm) (Ba)	LANDFORM: Morainal blankets, fluvial veneers and blankets.
SHRUBS [60]: Well developed with abundant Bl and less frequent Ba and Hm advance regen. *Vaccinium membranaceum* *Vaccinium ovalifolium* (*Menziesia ferruginea*) (*Sorbus sitchensis*) (*Sorbus scopulina*)	TEXTURE: Sandy loam, loam. DRAINAGE: Moderately good to good. EFFECTIVE ROOTING: 30–60 cm.
HERB [25]: Poorly to moderately developed. *Clintonia uniflora* *Rubus pedatus* *Orthilia secunda* *Streptopus roseus* (*Cornus canadensis*) (*Valeriana sitchensis*) (*Tiarella* spp.)	SOIL NAME: Orthic and Duric Humo-Ferric Podzols. HUMUS FORM AND DEPTH: Hemimors 2–6 cm.
MOSS [55]: Well developed; few feather-mosses. *Dicranum fuscescens* *Barbilophozia floerkei* *Peltigera* spp. (*Barbilophozia lycopodioides*) (*Rhytidiopsis robusta*) (*Pleurozium schreberi*)	OTHER FEATURES: Moderately deep soils (60–100 cm) without pronounced seepage; cemented horizons may restrict rooting at depths below 50 cm; mineral soil horizons with light colours and low organic matter content; humus forms have minimal H horizon development; soil moisture deficits expected.

COMMENTS: Most widespread site series of the ESSFI, although it occupies a relatively small geographical area compared to the other two subzones. Zonal sites are drier than in the ESSFi and k, and moisture deficits may occur. Soils are similar to those of mesic site series of the ESSFk. Forest productivity limited by short growing seasons marked by soil moisture deficits.

WHITEBARK PINE — LICHEN (ESSFl/02)

SLOPE POSITIONS:
Lithic phase: middle, upper, crests
Fluvial phase: middle, lower, level

SLOPE GRADIENT:
Lithic phase: 5–80%
Fluvial phase: 0–15%



VEGETATION LAYERS	SOILS	
	Lithic phase [ESSFl/02(a)]	**Fluvial phase [ESSFl/02(b)]**
TREE [23]: Open canopy of small-diameter trees. Pa Bl (Hm) (Pl)	LANDFORM: Colluvial or morainal veneers over bedrock.	Fluvial and glacio-fluvial blankets.
SHRUB [48]: Moderately to well developed with Bl, (Pa), and (Hm) advance regen. *Vaccinium membranaceum* *Sorbus sitchensis* (*Cladothamnus pyroliflorus*)	TEXTURE: Sandy and loamy skeletal.	Sandy skeletal.
	DRAINAGE: Good to rapid.	Rapid.
	EFFECTIVE ROOTING: 35–75 cm.	5–30 cm.
HERB [10]: Poorly developed. (*Cassiope mertensiana*) (*Empetrum nigrum*) (*Vaccinium caespitosum*) (*Antennaria neglecta*) (*Hieracium albiflorum*)	SOIL NAME: Orthic Humo-Ferric Podzols; Eluviated Dystric Brunisols	
	HUMUS FORM AND DEPTH: Xeromors. 1–10 cm.	Xeromors. 2–5 cm.
MOSS [73]: Very well developed; mosses and lichens co-dominate. *Cladina rangiferina* *Cladonia* spp. *Dicranum fuscescens* (*Barbilophozia floerkei*)	OTHER FEATURES: Only very coarse-textured or shallow gravelly soils are included in this series; highly permeable materials with low nutrient status.	

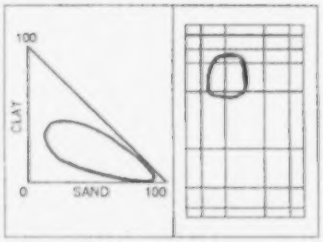
COMMENTS: Very low productivity site series that occupies considerable area in the rugged terrain of the Tahtsa and Sibola ranges. Insufficient fuels on these sites to carry a ground fire.

LICHEN — MOSS (ESSFI/03)

SLOPE POSITIONS: Upper and crests

SLOPE GRADIENT: 5–35%

ASPECT: South and southwest



VEGETATION LAYERS

TREE [40]: Relatively dense stands but with open canopies.
- Bl
- Hm
- (Pa)
- (Pl)
- (Ba)

SHRUB [66]: Well developed; common advance regen. of all species, particularly Hm, Bl.
- *Vaccinium membranaceum*
- *Menziesia ferruginea*
- *Sorbus sitchensis*

HERB [11]: Sparse to poorly developed.
- (*Empetrum nigrum*)
- (*Cornus canadensis*)
- (*Cassiope mertensiana*)
- (*Phyllodoce empetriformis*)

MOSS [75]: Well developed; mosses, lichens, and liverworts co-dominate.
- *Dicranum fuscescens*
- *Cladonia* spp.
- *Cladina rangiferina*
- *Barbilophozia floerkei*
- *Barbilophozia hatcheri*
- (*Pleurozium schreberi*)

SOILS

LANDFORM:
Morainal and colluvial veneers and blankets overlying bedrock; glaciofluvial blankets.

TEXTURE:
Variable, sandy skeletal to clay loam (shallow soils).

DRAINAGE:
Good.

EFFECTIVE ROOTING:
25–50 cm.

SOIL NAME:
Orthic and Duric Humo-Ferric Podzols.

HUMUS FORM AND DEPTH:
Hemimors and Xeromors.
2–5 cm.

OTHER FEATURES:
Shallower soils at upper slope positions, otherwise similar edaphically to mesic site series; water deficits significant in humus and upper mineral soil layers; cemented horizons and bedrock commonly restrict rooting.

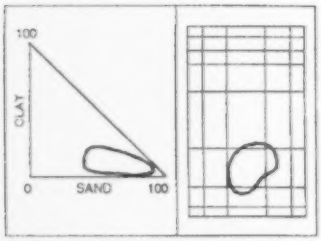
COMMENTS: Common site series in this subzone. Lichen cover is significant on submesic sites in the ESSFI, indicating that humus and mineral soil horizons dry out during the growing season. Submesic sites are more prominent in the ESSFI than in the other two ESSF subzones.

OAK FERN (ESSFI/04)

SLOPE POSITIONS: Lower to toe

SLOPE GRADIENT: 10–25%

ASPECT: Variable



VEGETATION LAYERS

TREE [43]: Open stands of large trees.
Bl
(Hm) — understory

SHRUB [50]: Well developed; common Bl advance regen. with less frequent Hm, Ba regen.
Vaccinium membranaceum
Vaccinium ovalifolium
Rubus parviflorus
Ribes lacustre
Sorbus sitchensis

HERB [59]: Well developed; quite diverse.
Gymnocarpium dryopteris
Valeriana sitchensis
Veratrum viride
Streptopus roseus
Tiarella spp.
Rubus pedatus
Arnica cordifolia
(*Clintonia uniflora*)
(*Cornus canadensis*)

MOSS [25]: Moderately developed cover of leafy mosses, liverworts, and *Dicranum*.
Dicranum fuscescens
Mnium spp.
Barbilophozia floerkei
(*Brachythecium* spp.)
(*Rhytidiopsis robusta*)

SOILS

LANDFORM:
Morainal or colluvial blankets, commonly associated with fluvial activity.

TEXTURE:
Coarse loams and sands.

DRAINAGE:
Moderately good.

EFFECTIVE ROOTING:
30–60 cm.

SOIL NAME:
Orthic Gleyed Humo-Ferric Podzols.

HUMUS FORM AND DEPTH:
Hemimors, Hemihumimors.
5–10 cm.

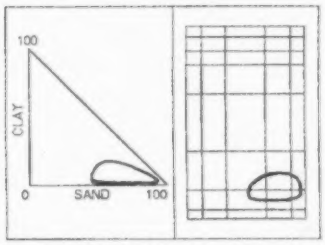
OTHER FEATURES:
Variable seepage input to lower B horizons; B horizons darker than those of mesic or drier sites; no water deficits; cemented horizons may perch water table.

COMMENTS: This site series is relatively uncommon in the ESSFI subzone. It represents very productive sites.

DEVIL'S CLUB (ESSFI/05)

SLOPE POSITIONS: Lower and toe

SLOPE GRADIENT: 15–40%



VEGETATION LAYERS

TREE [50]: Open stands of large decadent trees.
Bl

SHRUB [80]: Very well developed; abundant Bl advance regen. with less frequent Hm.
Oplopanax horridus
Rubus spectabilis
Ribes lacustre
Vaccinium ovalifolium
(*Vaccinium membranaceum*)

HERB [85]: Very well developed and diverse.
Gymnocarpium dryopteris
Athyrium filix-femina
Dryopteris assimilis
Tiarella spp.
Actaea rubra
Streptopus roseus
Valeriana sitchensis
Veratrum viride
Osmorhiza purpurea
Rubus pedatus

MOSS [48]: Dominated by leafy mosses.
Brachythecium spp.
Mnium spp.
Pellia neesiana
(*Drepanocladus uncinatus*)

SOILS

LANDFORM:
Washed colluvial blankets and aprons; fluvial fans.

TEXTURE:
Variable, coarse loams to sandy skeletal; plentiful coarse fragments.

DRAINAGE:
Imperfect.

EFFECTIVE ROOTING:
30–50 cm.

SOIL NAME:
Gleyed Sombric Humo-Ferric Podzols; Gleyed Humo-Ferric Podzols.

HUMUS FORM AND DEPTH:
Mormoders; Hemihumimors. 8–15 cm.

OTHER FEATURES:
Permeable soils in upper horizons due in part to loose consistence and high coarse fragment content; loose moders often with Ah development; seepage in lower B horizons; dark-coloured, fertile soils.

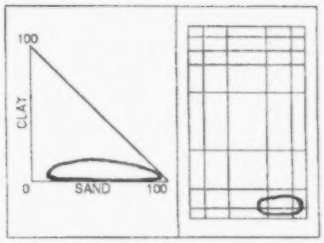
COMMENTS: The most productive site series for conifers in the ESSFI, but limited in extent.

HORSETAIL (ESSFI/06)

SLOPE POSITIONS: Toe and slight depressions

SLOPE GRADIENT: 0–15%

ASPECT: N/A



VEGETATION LAYERS

TREE [45]: Most trees growing on elevated hummocks.
- Bl
- Hm
- (Sxw)
- (Ba)

SHRUB [40]: Well developed; abundant advance regen. of Bl and infrequent Sxw.
- *Ribes lacustre*
- *Vaccinium membranaceum*
- *Vaccinium ovalifolium*
- *Menziesia ferruginea*
- (*Rubus spectabilis*)
- (*Lonicera involucrata*)
- (*Alnus viridis* ssp. *sinuata*)

HERB [58]: Diverse, dominated by horsetails.
- *Equisetum arvense*
- *Tiarella* spp.
- *Valeriana sitchensis*
- *Gymnocarpium dryopteris*
- *Rubus pedatus*
- (*Athyrium filix-femina*)
- (*Parnassia fimbriata*)
- (*Senecio triangularis*)
- (*Leptarrhena pyrolifolia*)
- (*Sanguisorba canadensis*)

MOSS [55]:
- *Mnium* spp.
- *Brachythecium* spp.
- *Drepanocladus uncinatus*
- *Marchantia polymorpha*
- *Pleurozium schreberi*
- *Barbilophozia* spp.

SOILS

LANDFORM:
Fluvial blankets; organic veneers over fluvial blankets.

TEXTURE:
Mushy organics overlying silt loam to sandy skeletal material.

DRAINAGE:
Poor.

EFFECTIVE ROOTING:
Primarily in humus to as deep as 30 cm in mineral soil.

SOIL NAME:
Orthic and Rego Gleysols; Gleyed Humo-Ferric Podzols.

HUMUS FORM AND DEPTH:
Hydromors: dominate wet areas.
Hemimors: on drier hummocks.
5–25 cm.

OTHER FEATURES:
Poorly drained soils, often saturated below 10–35 cm; intense mottling and dull grey colours common.

7 LITERATURE CITED

Canadian Soil Survey Committee (CSSC). 1978. The Canadian system of soil classification. Can. Dep. Agric., Publ. 1646.

Coates, D., and S. Haeussler. 1987. Guide to the use of mechanical site preparation equipment in north central British Columbia. Second edition. B.C. Min. For./Northern Silv. Committee/ Canada-B.C. Forest Resource Development Agreement. FRDA Handb.002.

Coupé, R., C.A. Ray, A. Comeau, M.V. Ketcheson, and R.M. Annas (compilers). 1982. A guide to some common plants of the Skeena area, British Columbia. B.C. Min. For., Land Manage. Handb. No. 4.

Klinka, K., R.N. Green, R.L. Trowbridge, and L.E. Lowe. 1981. Taxonomic classification of humus forms in ecosystems of British Columbia. First approx. B.C. Min. For., Land Manage. Rep. No. 8.

Pojar, J. 1988. Biogeoclimatic and ecoregion units of the Prince Rupert Forest Region. B.C. Min. For., Maps (2) @ 1: 500 000.

Pojar, J., K. Klinka, and D.V. Meidinger. 1987. Biogeoclimatic ecosystem classification in British Columbia. For. Ecol. Manage. 22: 119–154.

Pojar, J., R. Love, D.Meidinger, and R. Scagel. 1982. Some common plants of the Sub-Boreal Spruce Zone. B.C. Min. For., Land Manage. Handb. No. 6.

APPENDIX 1 Tree species symbols used in the guide

Tree symbol	Latin name	Common name
Acb	*Populus balsamifera* ssp. *balsamifera*	balsam poplar
Act	*Populus balsamifera* ssp. *trichocarpa*	black cottonwood
At	*Populus tremuloides*	trembling aspen
Ba	*Abies amabilis*	amabilis fir
Bl	*Abies lasiocarpa*	subalpine fir
Cw	*Thuja plicata*	western redcedar
Dr	*Alnus rubra*	red alder
Ep	*Betula papyrifera*	paper birch
Hm	*Tsuga mertensiana*	mountain hemlock
Hw	*Tsuga heterophylla*	western hemlock
Pa	*Pinus albicaulis*	whitebark pine
Pl	*Pinus contorta*	lodgepole pine
Sw	*Picea glauca*	white spruce
Sx	*Picea* (any or all of the three hybrids below)	hybrid spruce (undifferentiated)
Sxs	*Picea glauca* × *sitchensis*	Roche spruce
Sxw	*Picea glauca* × *engelmannii*	hybrid white spruce
Sxx	*Picea glauca* × *engelmannii* × *sitchensis*	three-way hybrid spruce

APPENDIX 2. List of plant names used in the guide

Abies amabilis	amabilis fir
Abies lasiocarpa	subalpine fir
Actaea rubra	baneberry
Alnus rubra	red alder
Alnus viridis ssp. *sinuata*	Sitka alder
Antennaria neglecta	field pussytoes
Antennaria spp.	pussytoes
Arctostaphylos uva-ursi	kinnikinnick
Arnica cordifolia	heart-leaved arnica
Arnica latifolia	mountain arnica
Artemisia arctica	mountain sagewort
Athyrium filix-femina	lady fern
Aulacomnium palustre	glowmoss
Barbilophozia floerkei	
Barbilophozia hatcheri	
Barbilophozia lycopodioides	common leafy liverwort
Barbilophozia spp.	
Betula glandulosa	scrub birch
Betula papyrifera	paper birch
Brachythecium spp.	
Calamagrostis canadensis	bluejoint
Cassiope mertensiana	white mountain-heather
Castilleja parviflora	small-flowered paintbrush
Chimaphila umbellata	prince's pine
Cladina mitis	
Cladina rangiferina	reindeer lichen
Cladina spp.	
Cladonia gracilis	
Cladonia spp.	
Cladothamnus pyroliflorus	copperbush
Clintonia uniflora	queen's cup
Cornus canadensis	bunchberry
Corylus cornuta	hazelnut
Dicranum fuscescens	curly heron's-bill moss
Dicranum spp.	
Drepanocladus uncinatus	sickle moss
Dryopteris assimilis	spiny wood fern
Empetrum nigrum	crowberry
Epilobium anagallidifolium	alpine willowherb
Equisetum arvense	common horsetail
Equisetum scirpoides	dwarf scouring-rush
Equisetum spp.	horsetails
Erigeron peregrinus	subalpine daisy
Festuca altaica	Altai fescue
Galium triflorum	sweet-scented bedstraw
Goodyera oblongifolia	rattlesnake-plantain
Gymnocarpium dryopteris	oak fern
Heracleum sphondylium	cow-parsnip
Hieracium albiflorum	
Hylocomium splendens	stepped feathermoss
Juniperus communis	common juniper
Leptarrhena pyrolifolia	leatherleaf saxifrage
Linnaea borealis	twinflower
Listera cordata	heart-leaved twayblade
Lonicera involucrata	black twinberry
Lupinus arcticus	arctic lupine
Lycopodium annotinum	stiff clubmoss
Marchantia polymorpha	
Menziesia ferruginea	false azalea
Mitella nuda	common mitrewort
Mitella pentandra	five-stamened mitrewort
Mitella spp.	
Mnium spp.	leafy mosses

Nephroma arcticum	
Oplopanax horridus	devil's club
Orthilia secunda	one-sided wintergreen
Osmorhiza purpurea	purple sweet-cicely
Parnassia fimbriata	fringed grass-of-Parnassus
Paxistima myrsinites	falsebox
Pellia neesiana	
Peltigera spp.	
Peltigera aphthosa	
Phleum alpinum	alpine timothy
Phyllodoce empetriformis	pink mountain-heather
Picea spp.	spruce
Picea engelmannii	Engelmann spruce
Picea glauca	white spruce
Picea glauca × *engelmannii* (?)	hybrid white spruce
× *sitchensis* (?)	Roche spruce
Pinus albicaulis	whitebark pine
Pinus contorta	lodgepole pine
Pleurozium schreberi	red-stemmed feather moss
Polytrichum spp.	haircap mosses
Populus balsamifera ssp. *balsamifera*	balsam poplar
Populus balsamifera ssp. *trichocarpa*	black cottonwood
Populus tremuloides	trembling aspen
Ptilium crista-castrensis	knight's plume feathermoss
Rhododendron albiflorum	white-flowered rhododendron
Rhytidiadelphus loreus	lanky moss
Rhytidiadelphus squarrosus	bent-leaf moss
Rhytidiadelphus triquetrus	electrified cat's-tail moss
Rhytidiopsis robusta	pipecleaner moss
Ribes glandulosum	skunk currant
Ribes lacustre	black gooseberry
Rubus parviflorus	thimbleberry
Rubus pedatus	five-leaved bramble
Rubus spectabilis	salmonberry
Salix spp.	willows
Sanguisorba canadensis	Sitka burnet
Saxifraga tricuspidata	three-toothed saxifrage
Senecio triangularis	arrowleaved groundsel
Shepherdia canadensis	soopolallie
Smilacina racemosa	false Solomon's-seal
Sorbus scopulina	western mountain-ash
Sorbus sitchensis	Sitka mountain-ash
Sorbus spp.	
Streptopus amplexifolius	clasping-leaved twistedstalk
Streptopus roseus	rosy twistedstalk
Thalictrum occidentale	western meadowrue
Thuja plicata	western redcedar
Tiarella spp.	foamflowers
Tomenthypnum nitens	golden fuzzy fen moss
Trisetum cernuum	nodding trisetum
Tsuga heterophylla	western hemlock
Tsuga mertensiana	mountain hemlock
Vaccinium alaskaense	Alaskan blueberry
Vaccinium caespitosum	dwarf blueberry
Vaccinium membranaceum	black huckleberry
Vaccinium ovalifolium	oval-leaved blueberry
Valeriana sitchensis	Sitka valerian
Veratrum viride	Indian hellebore
Viburnum edule	highbush-cranberry
Viola glabella	stream violet
Viola spp.	violets